

# FM 57-38

Reference

DEPARTMENT OF THE ARMY FIELD MANUAL

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## PATHFINDER OPERATIONS



HEADQUARTERS, DEPARTMENT OF THE ARMY  
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## PATHFINDER OPERATIONS

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\* This manual supersedes FM 57-38, 30 March 1961.

# **CHAPTER 1**

## **INTRODUCTION**

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### **1. Purpose**

This manual is a guide for commanders and staffs of ground and aviation units in organizing, training, and employing pathfinder detachments to furnish navigational assistance to Army aircraft. The manual is applicable to nuclear and nonnuclear operations of all combat and service units in the field.

### **2. Scope**

This manual outlines the procedures employed by pathfinder detachments during various types of operations, to include organization, planning, preparation, and execution of missions.

### **3. Comments or Recommended Changes**

Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded direct to the Commandant, United States Army Infantry School, Fort Benning, Ga.

### **4. Use of Glossary**

This manual contains a glossary of terms and definitions peculiar to pathfinder operations. Users of the manual are urged to read and refer to this glossary as an aid to understanding the text.

## CHAPTER 2

### PATHFINDER DETACHMENT

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#### 5. General

*a. Concept.* Pathfinders are infiltrated by land, sea, or air into an objective area to establish and operate navigational aids for guiding aircraft to the drop or landing zones. A flight coordination center from the Army aircraft traffic regulating and identification company may be provided to assist the ground force commander in controlling heavy density Army air traffic in forward areas of the division. The flight coordination center establishes, within its capabilities, the necessary ground-to-ground and ground-to-air communications to assist the force commander in coordinating the operations of pathfinder elements in the loading areas and in the objective area, and flights and serials operating between these areas. Pathfinders may be used in the loading areas to control air traffic within the loading areas and between the loading areas and the initial point (IP). Pathfinders in the objective area control air traffic within the drop and landing zones and between the communications checkpoint (CCP) and these zones. Air traffic between the IP and CCP may be monitored and regulated by the flight coordination center.

*b. Mission.* The mission of Army pathfinders is to provide navigational assistance to Army aircraft through operation of air-landing or air-delivery facilities on or over enemy-dominated or enemy-threatened areas.

*c. Assignment and Attachment.* Pathfinder detachments are assigned on the basis of one detachment for each aviation transportation battalion (transport aircraft). The detachments may be attached to either aviation or ground units to enhance the capability of these units to execute air-landed or air-delivery operations.

*d. Organization.* A detachment has two officers and 13 enlisted men (TOE 7-168D). Each

man must be a qualified parachutist and capable of performing the duties of other detachment members.

#### 6. Capabilities and Limitations

*a. Capabilities.* Pathfinder detachments are capable of—

- (1) Indicating with electronic and visual navigational aids the desired direction(s) and route(s) of movement for aircraft and the identity of selected points on the terrain; the identity and location of parachute and air-landed delivery areas; emergency ground-to-air signals; direction of landing, runway, taxiways, and parking areas for fixed-wing aircraft; and the presence of obstacles and directions and points of landing for helicopters.
- (2) Furnishing aviators, tactical commanders, and higher headquarters with information relative to the enemy and friendly situation, the wind, the weather, visibility, terrain conditions, chemical and radiological survey readings, and condition and elevation of delivery areas.
- (3) Providing aircraft commanders the necessary controls including directions, times, landing sites, traffic patterns, location times, altitudes, formations for parachute deliveries; and providing taxi, hover, parking, and takeoff instructions.
- (4) Selection and limited improvement of the exact areas for parachute, air-landed, and assembly operations, based upon reconnaissance information.
- (5) Indicating (by means of visual aids) the location of aircraft parking and unloading points, the initial direction

of movement, and the designated assembly points for air-delivered troops, equipment, and supplies.

- (6) Furnishing operators to handle radio and/or wire communications within landing zones and between these zones and the headquarters directing the operation. The wire-laying capability of these detachments is limited.
- (7) Infiltrating an objective area by any land, sea, or air means.
- (8) Operating drop or landing zones in forward areas for parachuted or air-landed supplies using fixed- and/or rotary-wing aircraft.

*b. Limitations.* Organic personnel and equipment strength of pathfinder detachments require that capabilities be limited primarily to aircraft guidance. It is necessary that these detachments be augmented by additional personnel from a supported unit to—

- (1) Provide security.
- (2) Remove obstacles.
- (3) Perform detailed radiological surveys.
- (4) Recover and assemble equipment and supplies.
- (5) Reconnoiter and mark troop assembly areas, if used.
- (6) Operate additional ground net radios and telephones.
- (7) Transport items of equipment.

## 7. Equipment

*a.* The pathfinder detachment is employed under the command and control of the aviation unit to which it is attached.

*b.* To accomplish their missions, the pathfinders are capable of performing the following:

- (1) Operate helicopter landing zones for an airmobile assault.
- (2) Operate fixed-wing aircraft landing zones.
- (3) Operate resupply drop zones.
- (4) Operate drop zones for parachute assault.
- (5) Perform radiological reconnaissance and surveys.

*c.* During these operations, pathfinders establish and operate drop or landing zones for the landing of troops, equipment, and supplies within enemy-held territory. They assist aircraft in the resupply, reinforcement, and evacuation of units within the combat zone.

*d.* Pathfinders shall precede the main assault elements into the delivery area, and arrive in sufficient time to properly perform their assigned missions. The amount of time needed depends on the mission(s), the number of pathfinders available, the means of delivery employed, the enemy situation, the terrain, and the weather. Normally, the required time varies from 10 to 30 minutes. However, the tactical situation may dictate earlier employment.

*e.* If the delivery of pathfinders ahead of the main body will compromise security, the pathfinders accompany the lead element of the main body and assist all subsequent flights. This procedure is especially applicable to daylight operations on terrain that aviators can locate without assistance. The need for aircraft control increases as the operation progresses. Enemy actions, mechanical failures, saturation of delivery areas, and desired changes in the landing plan to meet the changing tactical situation dictate efficient ground control of aircraft.

*f.* Aviators and transported troops must understand the purpose of the aids displayed and the techniques employed. Unit commanders must be thoroughly briefed on pathfinders' responsibilities and capabilities including the control of traffic within the drop or landing zones.

*g.* Pathfinder communication nets are available for use by the tactical unit commander. However, the use of these communication nets to perform pathfinder missions will take priority.

*h.* If the size and importance of the operation warrants, two pathfinder detachments and their equipment should be allocated for each mission. Such duplication offers greater assurance that at least one detachment will arrive in the objective area.

*i.* Aviators employed to transport pathfinder units are responsible for delivering them to

the desired location at the scheduled time. This requires coordination between aviators and pathfinders, including in-flight communication and observation of the ground from the troop compartment. The pathfinder aircraft may be equipped with special navigational devices. Checkpoints en route may be indicated by artillery fire, flares, navigational aids, or by partisans or patrols.

j. The pathfinder detachment coordinates its operations with those of the supported ground unit. To achieve maximum coordination, the pathfinder detachment must be familiar with the—

- (1) Ground tactical plan.
- (2) Departure area and time.
- (3) Loading plan.
- (4) Air-movement plan.
- (5) Landing plan.
- (6) Unloading plan.
- (7) Assembly plan.

## 8. Training

a. *Responsibilities.* Commanders of major units to which pathfinder detachments are assigned are responsible for pathfinder detachment training and proficiency, and for integrating this training with that of aviation and ground units.

b. *Standards.* Pathfinders will be trained to accomplish the missions and duties prescribed in this field manual in accordance with the highest standards of proficiency.

## 9. Pathfinder Equipment

a. *General.* The TOE of the pathfinder detachment provides two sets of equipment essential to pathfinder operations. A dual-equipment organization insures operational effectiveness.

b. *Navigational Aids.* Navigational aids are used to help aviators locate an exact area. Electronic and visual navigational aids are the two principal types employed.

- (1) *Electronic aids*, which include homing beacons and radios, employ a radio signal. They have a greater range and provide more security than visual navigational aids. While radio ordinarily

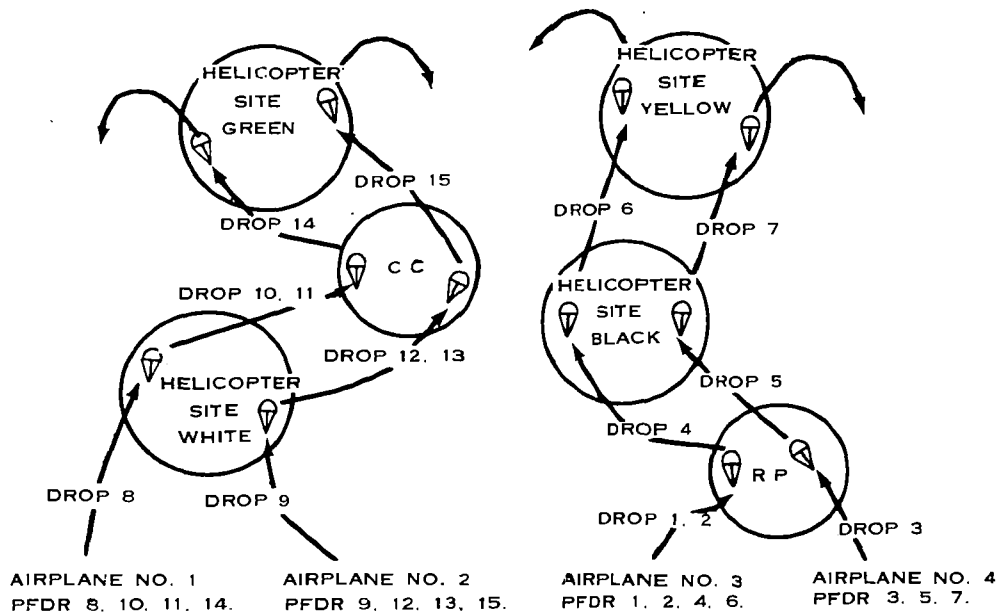
is considered an insecure means of signaling, it is a relatively secure means in pathfinder operations because of the time required by an enemy to obtain a direction finding (DF) fix and dispatch a force to the area.

- (2) *Visual navigational aids* are used to designate specific areas or points in landing and drop zones. They are also used in transmitting ground-to-air signals. Daytime visual navigational aids include panels and smoke. Night visual navigational aids include light beacons, lanterns, baton flashlights, and pyrotechnics. Visual navigational aids provide less security in that flares, pyrotechnics, and other illuminating devices may be easily seen by the enemy.

c. *Communication Equipment.* Organic communications equipment insures the capability of ground-to-air voice radio communications to operate a pathfinder control net and to maintain communication with supported units. A capability of a homing signal has been well incorporated within most of the communication equipment to provide additional navigational assistance.

d. *Assembly Aids.* Assembly aids are used to designate troop- or supply-assembly areas. As with navigational aids, there are two principal types of assembly aids: electronic and visual.

- (1) *Electronic assembly aids* include radios and homing devices which employ a radio signal. They provide more security and greater range than visual assembly aids.
- (2) *Visual assembly aids* are simple to employ and afford positive identification of assembly areas, but they can be seen by enemy and friendly troops. Visual assembly aids include panels, smoke, and armbands for day operations; and lanterns, flashlights, light beacons, and pyrotechnics for nighttime operations.



- PATHFINDERS PARACHUTE TO SITE AT POINTS INDICATED BY THIS SYMBOL.  
 — PATHFINDERS LAND ON SITE AT POINTS INDICATED BY THIS SYMBOL.  
 R P — RELEASE POINT FOR AIRCRAFT OF MAIN BODY.  
 C C — CONTROL CENTER FOR LANDING ZONE.

NOTE: CROSS-LOADING OF AIRCRAFT PERMITS MAXIMUM DISPERSAL OF PATHFINDERS WITHIN THE AVAILABLE AIRCRAFT, ALLOWING THE REMAINING PATHFINDERS TO COMPLETE THE MISSION SHOULD AN AIRCRAFT BE LOST.

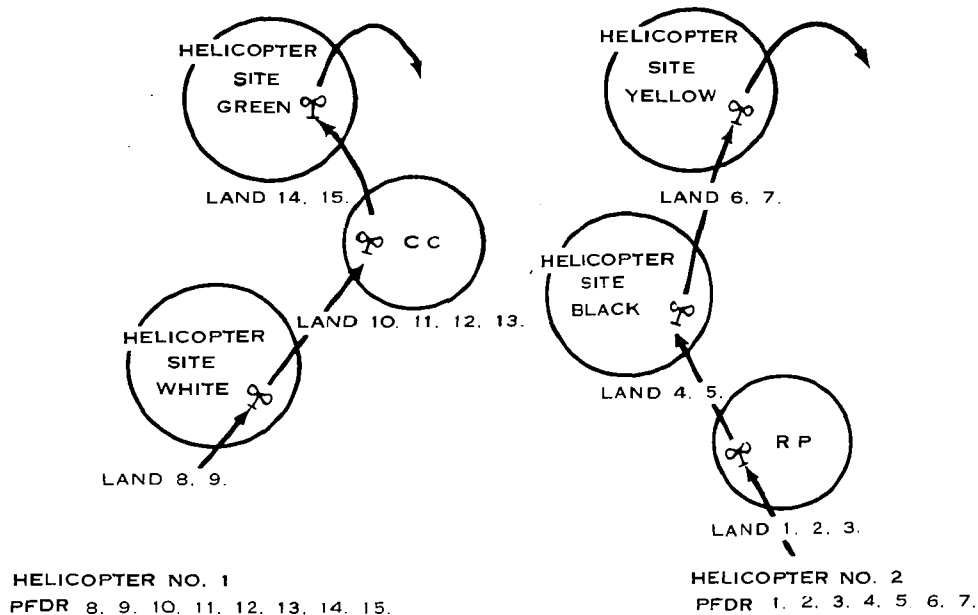


Figure 1. Air delivery to multiple sites (above). Air landing at multiple sites by helicopter (below).



## CHAPTER 3

### PLANNING

#### Section I. PRELIMINARY PLANNING

##### 10. Initial Coordination

a. Pathfinder detachments are made available to supported units by arrangement with the division G3.

b. At the earliest practicable time, the commander issues a warning order to alert the pathfinder detachment to its forthcoming support mission and also establishes liaison with the commanders of the supported ground unit and the supporting aviation unit.

##### 11. Initial Preparations

a. Inspection of the pathfinder unit's personnel and equipment begins immediately upon receipt of the warning order. Personnel transfers and replacements and equipment augmentation should be accomplished as the needs arise.

b. Equipment is prepared in accordance with the following priority:

- (1) Navigational aids.
  - (a) Electronic.
  - (b) Visual.
- (2) Ground communication equipment.
- (3) Weapons.
- (4) Assembly aids.
- (5) Miscellaneous items.

c. As additional information is received, pathfinders are reorganized as necessary within the detachment to be better prepared to accomplish the specific mission. Time permitting, additional training and rehearsals should be conducted, using terrain that most nearly resembles the objective area.

d. Security is mandatory for the success of the operation. Therefore, personnel should be

provided the minimum essential information needed to complete each phase of the operation. Individuals who have received detailed information about the operation should be isolated for security reasons.

##### 12. Joining With the Supported Unit

a. Pathfinders join the supported unit at the appointed time and place. If conditions will allow, final coordination among the unit, aviation, and pathfinder commanders is accomplished at this time. This coordination includes but is not limited to the following:

- (1) Ground tactical plan.
- (2) Departure area and time.
- (3) Loading plans.
- (4) Air movement plan.
- (5) Landing plan.
- (6) Unloading plan.
- (7) Assembly plan.

b. The pathfinder detachments and the aviation units are designed to support the tactical operations of the ground unit commander. Drop or landing zones are selected to support the ground tactical plan. Alternate drop or landing zones must be prearranged for emergency use. Circumstances under which they will be employed must also be prearranged. One or more drop and/or landing zones may be operated within the same airhead if sufficient pathfinder personnel and equipment are available (fig. 2).

c. The landing plan must support the aircraft unloading plan and the initial assembly of troops, supplies, and equipment. Unloading and assembly operations must be conducted without interfering with the arrival and departure of aircraft. To accomplish this, air-

craft, personnel, supplies, and equipment must be rapidly cleared from the landing and parking areas. Since only tentative direction of landing and areas for landing and parking can be determined before the pathfinder reconnaissance is completed, specific unloading and initial assembly points cannot be designated until after pathfinders have arrived in the objective area. Upon arrival, pathfinders designate exact unloading and initial assembly points sited as near unit assembly points as practicable. Individuals move from initial assembly points designated by pathfinder personnel, to their preplanned unit assembly areas prescribed by the unit commander.

d. The aircraft-landing or parachute-delivery plan should assure that the desired personnel and equipment are delivered in the objective area at the time and place prescribed. The plan should permit maximum numbers of aircraft deliveries in a minimum amount of time. Efficiency of the plan will depend upon the capabilities of the involved pathfinder and aviation units.

e. The movement plan includes delivery of pathfinders and main assault elements. Routes to and from the drop or landing zones are selected to provide maximum protection to aircraft, to maintain the security of the operation, and to support the landing plan. Pathfinders assist in the movement of the main element by operating navigational aids and furnishing guidance and control to the aircraft. In the airhead, pathfinders control the activities of all aircraft within the drop and/or landing zones to ensure safe and efficient operations. Recognized pilot prerogatives in emergency situations remain in effect. Pilots will make every effort to inform pathfinders of emergency measures being planned or taken.

f. Consideration should be given to furnishing artillery and tactical air support to the pathfinder party.

### 13. Coordination

Commanders of ground and aviation units coordinate and preplan the details of operations which require pathfinder assistance. The pathfinder detachment commander may make rec-

ommendations on the location of the drop or landing zone, the formation to be flown, and the time schedule to be followed. The aviation unit commander coordinates with the ground unit commander on such matters as flight formation, time schedule, primary and alternate flight routes, communications checkpoints, and types of loads.

### 14. Briefing

Each pathfinder must fully understand the specific duties he is to perform in the objective area. He must be thoroughly briefed on the location and operation of proposed air-landing or air-delivery facilities; on the flight route, flight formation, and time schedule; and on the communications checkpoint. He should be given an opportunity to study pertinent maps, air-photos, and terrain models of the objective area.

### 15. Final Preparations

a. Based upon coordinated plans for the operation, the pathfinder detachment commander requests the necessary augmentation in personnel and equipment. He bases this request upon the planned use of personnel and equipment for security operations; for assembly of personnel, supplies, and equipment of supported units; for removal of obstacles; for radiological survey; for operation of ground net communications equipment; and for transportation and operation of navigational and assembly aids under pathfinder direction. Personnel and equipment augmentation must be in keeping with the transportation means to be used in delivering the pathfinder party. When feasible, a unit liaison and fire support group accompanies the pathfinder party to provide artillery and tactical air support and establish communications on the ground net. When thus reinforced, the pathfinder party remains under the full command of the pathfinder commander who is responsible for the functions of the entire team.

b. The pathfinder commander issues his operations order to the reinforced detachment as soon as practicable. The operations order may be issued as a series of fragmentary orders based upon available information or the neces-

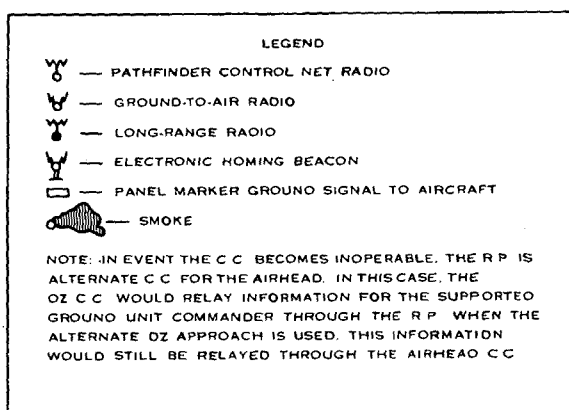
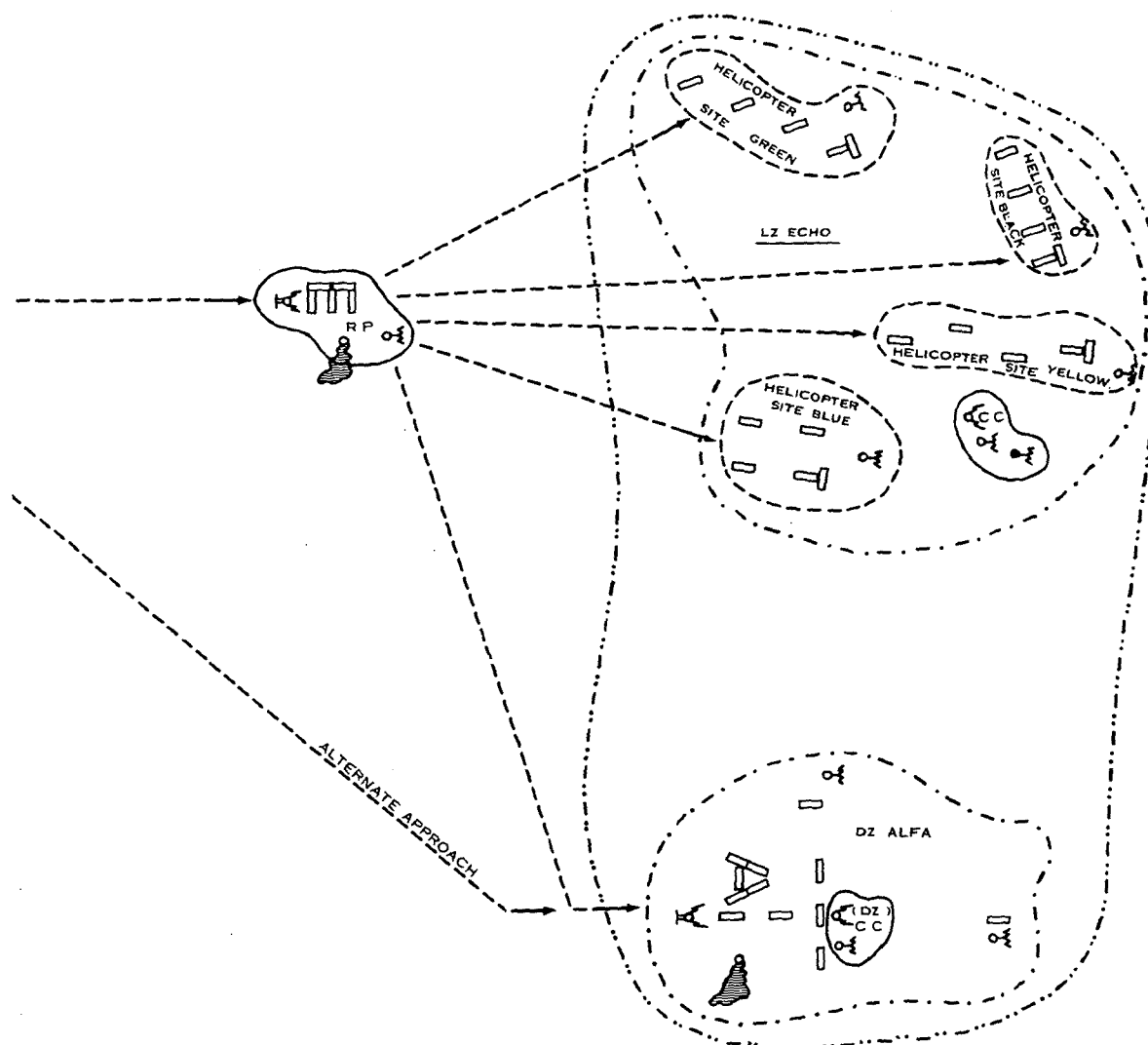


Figure 2. Airhead with one drop zone and one helicopter landing zone.

sity to disseminate it. The commander assures that individuals receive a detailed briefing of their exact duties.

c. A final detailed check is made of the equipment to be used in the operation. A decision is made on the exact manner in which the equipment is to be transported into the

objective area. All items of equipment are prepared for rapid displacement.

d. A final weather and operation briefing is held at the departure area just prior to departure. A final coordination meeting with the ground and aviation unit commanders and the pathfinder pilots is also held at this time.

## Section II. DELIVERY OF PATHFINDERS

### 16. Method of Delivery

Pathfinders can be delivered by any of a variety of ground, sea, or air transportation means. The two means most often employed are parachuting from Army fixed-wing aircraft and landing by helicopter (fig. 1). Helicopters can also be used to deliver pathfinder detachments by parachute. Procedures for parachute-delivery from specific types of aircraft are contained in TM 57-220.

### 17. Parachute Delivery

a. Compared to landing by helicopter, parachute delivery offers more security, is less vulnerable to enemy fire, affords greater range and speed of movement, and allows use of terrain which precludes helicopter landings.

b. Based upon wind conditions, pathfinders compute their desired parachute release points prior to arrival in the area. Parachute jumps and air drops are made at the lowest practicable altitude in order to increase the accuracy and security of the operation. For parachuted containers, an altitude of 150 to 300 feet is practical for low-velocity drops depending on the parachute used. The minimum altitude for a high-velocity parachute delivery of a one-pilot-chute load is 400 feet, and for a three-pilot-chute load, the minimum altitude is 500 feet. Delivery at lower altitudes is desirable for free-drop equipment. Jump altitudes for personnel are prescribed in standing operating procedures for the types of parachutes involved and will vary in accordance with peacetime and wartime restrictions.

c. When parachuting into an area, pathfinders carry on their person the essential operational items of equipment. This technique

insures maximum protection of fragile items and provides immediate access to operational equipment immediately upon landing.

### 18. Landing by Helicopter

a. Landing by helicopter is more accurate than parachute delivery and can be carried out under higher wind conditions. More personnel and equipment in a better state of operational readiness can be delivered by helicopters. Use of helicopters furnishes a means of aerial radiological monitoring and pathfinder evacuation, enables nonparachutists to accompany pathfinders in a supporting role, offers a delivery means when low ceilings prohibit parachute jumping, and furnishes a delivery means for the 1/4-ton truck with AN/VRQ-3 radio.

b. Upon arrival in the objective area, pathfinders perform a hasty visual reconnaissance of their respective areas of operation. If they are not delivered to the desired points, they are moved by helicopter to the proper locations as quickly as possible. Pathfinder helicopters remain at each location until released by the pathfinder detachment commander.

c. When possible, the pathfinder detachment should be transported in two or more helicopters. Each helicopter should make a minimum number of deliveries in order to speed the operation. Helicopters may land at a concealed terrain feature while pathfinders perform certain functions such as displaying visual aids, and then transport personnel to other points. Helicopter movement in the landing zone should be restricted in order to minimize the noise and/or dust which could reveal friendly positions and intentions to the enemy. During aerial radiological surveys, it may be necessary to reduce helicopter loads because of

the necessity to hover at low altitudes while radiological readings are being made.

d. At least one helicopter should remain within the objective area to provide pathfinders with an alternate means of transportation, observation, and communication. When all available transport helicopters are needed elsewhere, it may be necessary to provide an observation-type helicopter for this purpose.

### **19. Landing by Fixed-Wing Aircraft**

a. Fixed-wing landing delivery is more accurate than parachute delivery. Also more

personnel and equipment can be delivered in a better state of operational readiness by fixed-wing aircraft than by parachute. Fixed-wing landings enable nonparachutists to accompany pathfinders and offer a possible delivery means when low ceilings prohibit parachute jumping.

b. As compared to helicopter delivery, fixed-wing landing gives greater range and speed of movement. The necessity for comparatively large, obstacle-free landing areas, however, limits the use of fixed-wing aircraft for pathfinder delivery.

## **Section III. ACCOMPLISHMENT OF MISSIONS**

### **20. Capabilities**

a. An essential element of a successful pathfinder operation is communication by ground-to-air voice radio. This radio is one of the first items placed in operation by pathfinders, and it should be the last item of equipment taken out of operation. Pathfinders must have a thorough understanding of voice radio procedure. To achieve the necessary speed and clarity of transmission, radio discipline must be practiced by pathfinders and aviators. Extraneous and unnecessary messages should be omitted. Because of the amount of vital information exchanged, the copilots of aircraft normally record the more important portions of messages. Aviators repeat vital portions of a ground-to-air message to the control center to insure that proper instructions are being followed. For examples of ground-to-air message transmissions, see paragraphs 35 and 42.

b. Upon landing in the objective area, pathfinders perform a hasty reconnaissance, select the desired locations, assemble the assigned personnel and equipment at these locations, and establish the necessary landing aids. They perform these functions as rapidly as possible. In most cases they perform two or more simultaneously. Each person performs his assigned task. No one task, however, requires the services of the assembled group.

c. In addition to the augmentation personnel which function under pathfinder command, the

following personnel may accompany the pathfinder detachment when appropriate: forward air controllers, artillery observers, and liaison personnel who can communicate with the unit commander.

### **21. Assembly After a Mission**

a. When a mission has been completed, the pathfinder detachment assembles with its equipment.

b. Immediately upon arrival, the pathfinder detachment commander reports his detachment's state of operational readiness to the commander of the supported unit. He makes his report at a prearranged time and place.

c. Upon completion of a mission, attached or augmentation personnel revert to their parent units. They may do this prior to assembly of pathfinder personnel.

d. The pathfinder detachment commander notifies his parent unit commander of the completion of the detachment mission and takes immediate steps to prepare his detachment for further operations.

### **22. Secondary Employment**

a. Pathfinder personnel and equipment remain assembled at the unit command post, except when performing pathfinder duties for subordinate units.

b. When the pathfinder detachment has completed preparations to perform further mis-

sions, it may be employed within the command post of the supported unit to—

- (1) Assist communications personnel by operating radios or telephones.
- (2) Assist in minor demolition, radiological survey, and mine warfare tasks.
- (3) Assist staff sections by performing map and aerial photo work.

- (4) Augment local security by acting as interior and exterior command post guards.

c. Training and maintenance may, as required, take priority over performance of secondary missions.

d. The pathfinder detachment must be able to perform any of the assigned pathfinder missions with a minimum of preparation.

## CHAPTER 4

### OPERATION OF A HELICOPTER LANDING ZONE

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#### Section I. RECONNAISSANCE AND PLANNING

#### 23. General

Reconnaissance of drop or landing zones for helicopters and fixed-wing aircraft is an important pathfinder task. Although tentative drop zones or landing sites can be selected from maps and aerial photographs prior to an operation, exact sites cannot be established until a terrain reconnaissance has been made. This chapter discusses the planning and organization of the terrain reconnaissance required to establish a helicopter landing zone.

#### 24. Planning

##### *a. Coordination.*

- (1) The pathfinder detachment commander coordinates with the commander of the supported unit on the location of the helicopter landing zone. The actual location is selected by the commander of the supported unit and is based upon terrain considerations, objectives, and the advice of the helicopter unit commander.
- (2) The pathfinder detachment commander also coordinates with the helicopter unit commander on exact helicopter landing requirements in terms of specific areas, desired ground conditions, and types of navigational aids to be used. The detachment commander coordinates with the pathfinder helicopter aviators on exact flight routes and suitable checkpoints and time schedules.

*b. Reconnaissance.* Whether pathfinders are delivered by helicopter or by parachute, air reconnaissance of the landing zone during delivery often proves valuable. This reconnais-

sance should not be so extensive that it will compromise the security of the operation or cause loss of valuable time.

##### *c. Selection of Landing Sites.*

- (1) In selecting land sites for helicopters from maps, aerial photographs, and actual ground reconnaissance, the following factors are considered:
  - (a) *Size of landing point.* As a guide, rotary-wing aircraft need a cleared, level, circular area at least 50 meters in diameter for landings during the day, and an area 75 meters long by 50 meters wide for landings at night.
  - (b) *Number of helicopters used.* An important factor is the number of helicopters required to land simultaneously at one site to provide the troop strength needed to accomplish the mission. It may be necessary to provide an additional landing site nearby or to land the troops in successive flights at the same site.
  - (c) *Surface conditions.* Surface conditions must be good enough to prevent helicopters from bogging down or creating excessive dust. Loose debris that may cause damage to the rotor blades must be removed.
  - (d) *Ground slope.* Normally, if the ground slope is greater than 15 percent helicopters cannot land safely.
  - (e) *Approaches to the landing site.* The direction of landing should be into the wind, especially at night. However, if there is only one good approach, certain aircraft can land

crosswind; or if surface wind is light, some aircraft can land downwind.

- (f) *Prevailing winds.* Of the two factors—approach route ((e) above) and prevailing wind—the best approach route is the more important factor unless the wind velocity exceeds 10 knots.
  - (g) *Density altitude.* The density altitude is affected not only by altitude, but by temperature and humidity. For planning purposes, as density altitude increases, the size of the landing site must be increased proportionately.
  - (h) *Load.* Some helicopters cannot ascend or descend vertically when fully loaded; therefore, a larger landing area is required for fully loaded helicopters than for empty or lightly loaded ones.
  - (i) *Landing sites.* Landing sites should be free of telephone or power lines or similar obstructions that may interfere with the helicopter landings.
- (2) Detailed information on the effects of air density, slope, and surface conditions on landing zone requirements is contained in TM 5-251. The helicopter unit commander makes the final decision on minimum landing requirements. These requirements must be available to the pathfinder detachment commander in the early planning stages for the mission.
  - (3) When tentative landing sites have been selected, pathfinder personnel are thoroughly briefed on their specific work sites. Aerial photographs are especially useful for this briefing. In any case, these should be made available prior to the start of operation so each person will have an accurate mental picture of his landing site.
  - (4) Use of attached personnel to assist in ground reconnaissance should be care-

fully planned ahead of time. These personnel should be thoroughly briefed and rehearsed.

- (5) Selections of primary and alternate helicopter landing points must be made at each landing site. Alternate points are chosen to permit operation of a landing site in case a primary point becomes inoperative.
- (6) Each helicopter landing site should be within ground communications range of the control center. The range of the AN/PRC-10 radio requires that each landing site be within an 8-kilometer radius of the control center.

*d. Location of Landing Zone Control Center.* The control center is centrally located within the landing zone and situated on terrain that permits effective communication, visibility, and security. Centralized location of the control center increases the range of the radios and facilitates accomplishment of the operational mission. A control center located near a landing site increases the security of both installations. Though it is not necessary that the control center provide observation of all landing sites, it is a desirable characteristic. The commander of the supported unit must be consulted concerning the proposed location of the control center. Ground communication with each landing site through the pathfinder control net radio is an important consideration in selecting the location for the control center.

*e. Selection of Release Point.* Normally the release point (RP) is selected from the map and aerial photograph study. The release point is a point on the planned flight route to the landing zone. It is usually located near a prominent natural terrain feature or man-made object and on high, open ground that affords maximum use of long-range electronic and visual navigational aids.

*f. Selection of Assembly Points.* Assembly points are tentatively selected adjacent to the landing site at locations agreed upon by the supported unit commander and pathfinder detachment commander. A ground reconnais-



sance must be conducted after the pathfinders land, to establish the exact locations of the assembly points.

*g. Obstacles.* During the reconnaissance of the landing sites, all natural and artificial obstacles are neutralized, marked, or removed. Minor obstacles such as small trees, brush, holes, or ditches can usually be eliminated. Tall, dry grass must be cleared from the landing site to prevent helicopter exhaust from starting grass fires. Major obstacles are marked for removal at a later date. Minor obstacles are removed prior to the arrival of the first helicopter. When this is not possible, they are marked by red panels or red lanterns, or identified by some other prearranged signal for removal as the operation progresses. Aerial photographs of the proposed landing sites assist in planning for the marking or removal of obstacles. Obstacle removal begins as early as possible and continues as long as necessary.

*h. Night Operations.* If pathfinders are delivered during twilight, initial aerial and ground reconnaissance is performed according to the same plans as for a daylight operation. Continuing reconnaissance and improvement of the landing site is slower and more difficult at night. Therefore, if pathfinders are to be delivered after the end of evening nautical twilight, more time must be allowed to complete the ground reconnaissance.

*i. Reporting Information.* Following completion of the landing site reconnaissance, pathfinders must report the results to the control center. The landing direction and information of the enemy should be transmitted to the control center as soon as possible after the path-

finder landing. This information is transmitted from the landing sites to the control center over the pathfinder control net and must be prearranged. The pathfinder detachment commander takes immediate steps to determine and transmit other needed information to the individuals most directly concerned.

- (1) He notifies the supported unit commander (via long-range radio net) of—
  - (a) *EEI* as required by operation order.
  - (b) Results of radiological monitoring.
  - (c) Conditions that might require changes in landing zones (*LZ's*), drop zones (*DZ's*), or assembly areas.
- (2) He notifies the aircraft unit commander, serial or flight leader, or individual aviator as applicable (via air/ground radio net) of—
  - (a) The magnetic heading from the communications checkpoint to the RP, specific helicopter site, land azimuth, landing strip, or drop zone.
  - (b) Obstacles located at or near landing or air-delivery facilities.
  - (c) The traffic pattern for approach to and departure from the landing or drop zone(s).
  - (d) Wind direction and velocity.
  - (e) Altitude of approach.
  - (f) Elevation of the air-delivery or landing facility.
  - (g) Altitude for air-delivery (if applicable).
  - (h) Other information as necessary.

## Section II. ORGANIZATION OF A LANDING ZONE

### 25. Installations

A helicopter landing zone contains one or more landing sites, a control center, and a release point (fig. 2). The control center (CC) is the command post and communications center used in controlling the operation of the landing zone. The basic organization of the

control center remains essentially the same for all pathfinder operations. The allocation of personnel to the control center is normally the minimum number required to operate the facility. If the detachment is augmented, more personnel should be made available to perform this and other necessary tasks.

## 26. Drop/Landing Zone Control Center

*a. General.* The purpose of the control center (fig. 3) is to control air traffic on the approach to and within a landing area, and to promote safe, orderly, and expeditious air movement. The CC is the pathfinder command post and communications center. Its location is tentatively selected by map reconnaissance and air photo study. The tentative location is changed if ground reconnaissance indicates it is not suitable. The CC is normally established on terrain dominating the facility(ies) to be operated. This ensures maximum visual and radio communication ranges. In some instances, it may be advantageous to establish it at one of the facilities in order to make the best possible use of available manpower. An example is the establishment of the CC at the drop zone (DZ) where CC personnel assist the T party (pars. 36 and 37) or are employed to increase security of operations. If the CC is established at a fixed-wing facility, its radios must be set up far enough from the landing, taxiing, and parking installations to prevent aircraft engine noise interference in radio transmissions. In addition, terrain masks must be carefully avoided if the CC is to make and maintain radio contact with all other operating facilities.

### *b. Organization and Duties of the CC Party.*

(1) The CC should be organized to meet the requirements of the mission. A typical organization consists of—

- (a) *Pathfinder detachment commander.* He acts as the LZ or DZ control officer and controls aircraft landings and departures or air deliveries. To provide maximum support, he may also be the ground-to-air radio operator ((b) below).
- (b) *Ground-to-air radio operator.* He operates the radio used to maintain communication with aircraft in flight, and aids in the control of aircraft by observation.
- (c) *Pathfinder control net operator.* He operates the radio used to maintain

communication with other elements of the detachment. He aids in the control of aircraft by observation, and he maintains a record (app. II) of aircraft arrivals and departures and the general types of loads. If the LZ has more than five landing facilities but only one CC, two pathfinder control communication nets should be established with an operator for each.

- (d) *Long-range net radio operator.* He operates the radio used to communicate with supported units and with elements in the base or landing area.
  - (e) *Security personnel.* They defend the CC against enemy attack, assist in carrying and installing equipment, and provide other assistance as necessary.
- (2) A CC must be established for each DZ and LZ. Normally there is a primary CC and one or more secondary CC's. The detachment commander is located at the primary CC. When only one secondary CC is employed, the detachment executive officer is responsible for its functions. When there are more than one, the pathfinder detachment commander designates the individual responsible for their functioning (fig. 2).

## 27. Release Point

*a. General.* A release point (RP) (fig. 4) is established to provide a traffic control point and final navigation checkpoint for aircraft approaching the landing or air-delivery facilities within a landing area. The RP is used primarily to control helicopter traffic into an LZ containing multiple helicopter landing sites, but it may also be used as an aid to navigation and traffic control when more than one drop and/or landing facility is established in the landing area. The RP location is tentatively selected from map and air photo studies as a point on the planned flight route to the landing zone. It should be located on a prominent ter-

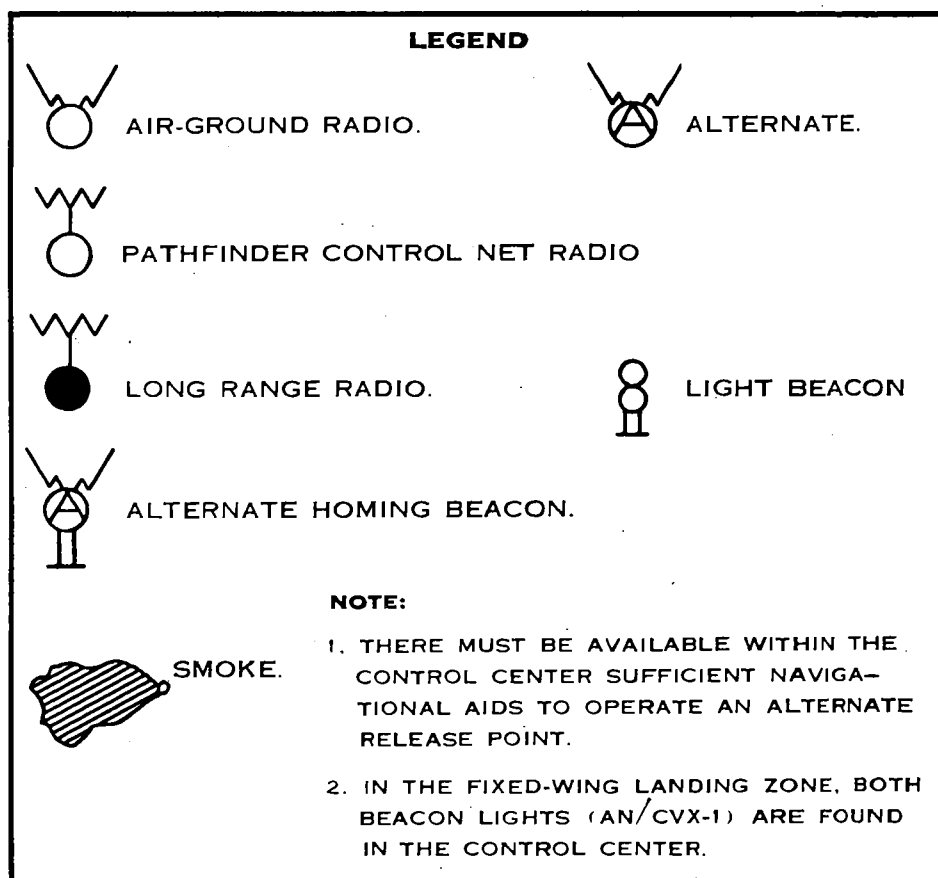
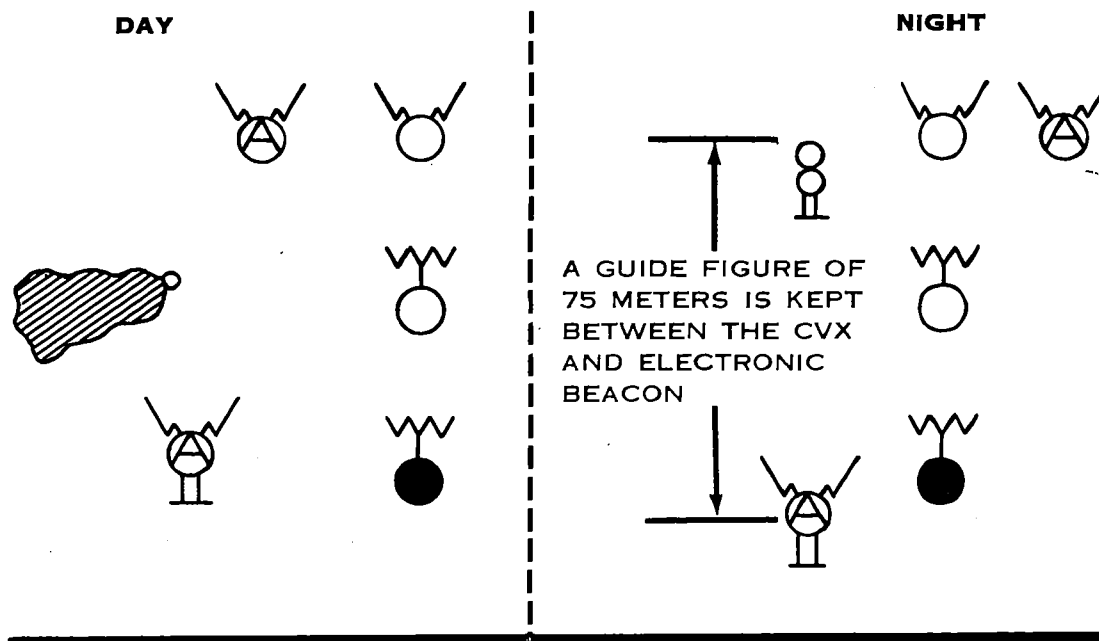


Figure 3. Control center..

rain feature or on high, open terrain which allows maximum effective use of long-range electronic and visual navigational aids. Through duplication of equipment, the release point, in case of an emergency, can assume the duties of the control center. Also, the control center can assume the duties of the release point.

*b. Organization and Duties of the RP Party.*

- (1) The RP party will include one pathfinder with attachments or at least two pathfinders. The pathfinders position and operate the electronic and visual navigational aids. They also operate a radio in the pathfinder control net.
- (2) The party may include attached personnel to defend the RP against attack and assist in carrying, assembling, and operating equipment.

*c. Operation of the RP.*

- (1) The pathfinder in charge of the RP, assisted by available security personnel as needed, immediately installs the navigational aids.
  - (a) He first prepares the electronic homing beacon for operation since it affords long-range guidance and

greater security than visual aids. He locates the beacon far enough away to prevent excessive interference with the ground radio and to reduce the possibility of enemy fire destroying both radios simultaneously. He places the beacons in operation at the prescribed time.

- (b) He then prepares the visual navigational aids for operation. Visual navigational aids are used to indicate locations aviators can positively identify (figs. 2 and 4). Grass or brush may have to be removed to prevent masking these aids.
- (2) The pathfinder control net radio operator establishes communication with the CC as quickly as possible to report the state of readiness of the RP's and provide information on the enemy situation. He keeps his radio on constant standby, unless directed to operate it on a definite time schedule.
- (3) Individual security personnel move to assigned locations and take up firing positions or assist in establishing and operating navigational aids and communication equipment.

### **Section III. HELICOPTER LANDING ZONE**

#### **28. General**

*a.* A helicopter landing zone contains one or more helicopter sites. It may have its own CC or RP, or it may use these in conjunction with an adjacent *DZ* or *LZ*.

*b.* The pathfinder detachment is organized into three basic parties for operating the zone: the CC party, the RP party, and the helicopter site party. The CC and RP are organized and operated as described in paragraphs 25, 26, and 27; the helicopter sites are discussed in paragraph 29.

#### **29. Helicopter Site**

Minimum landing space requirements and minimum distance between aircraft depend upon a number of variables and should be prearranged by the aviation unit commander in coordination with the pathfinder detachment commander. The final decision concerning minimum landing requirements rests with the aviation unit commander.

*a. Selection.* In addition to the considerations in selecting the landing site as discussed in paragraph 24c, the following procedures apply:

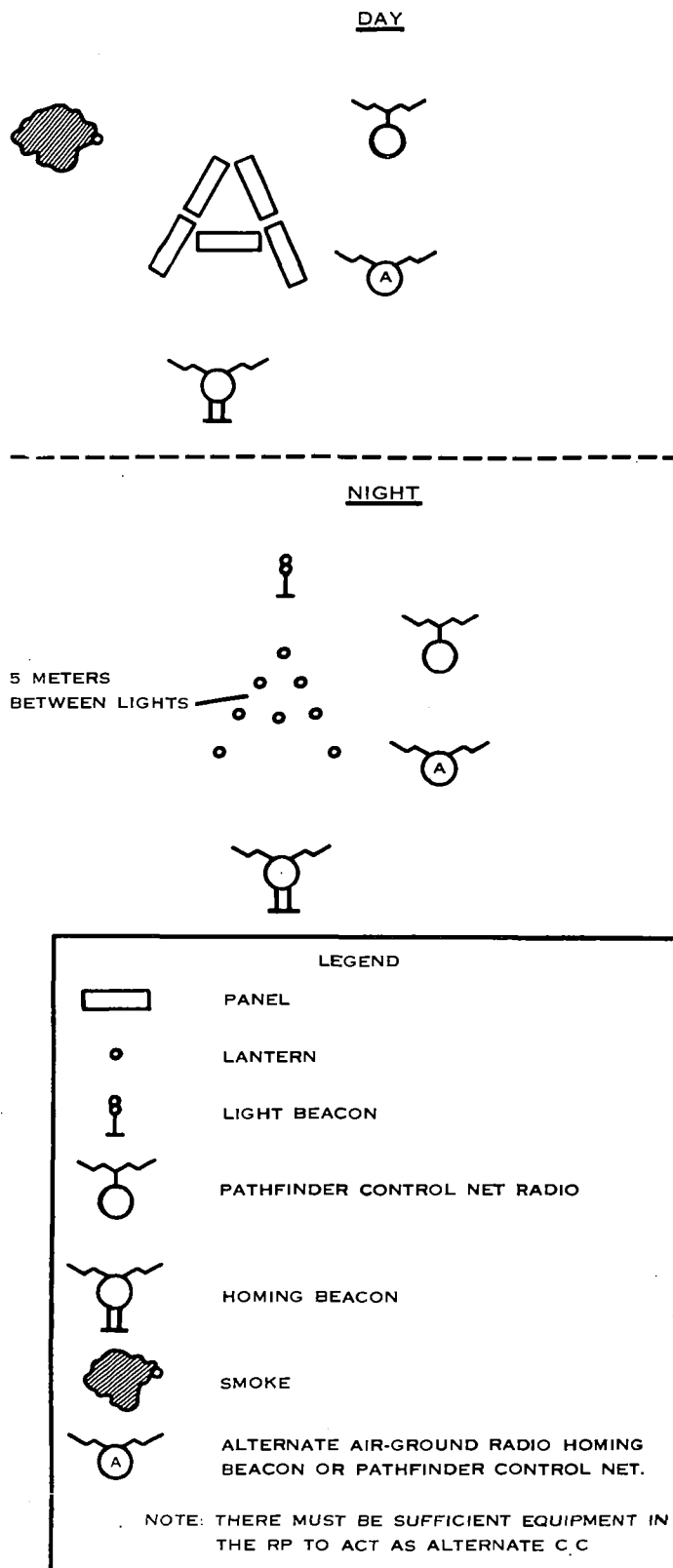


Figure 4. RP (release point) schematic.

- (1) Alternate landing points are selected at each helicopter site.
- (2) Alternate sites may be needed because of enemy action, ground conditions, or changes in the tactical or logistical situation. They are selected primarily to support the tactical plan. The ground commander or his representative decides when alternate sites will be used, and the pathfinder commander informs the landing site operators of the change to alternate sites.
- (3) Each helicopter site must be located within ground radio communication range of the CC.
- (4) A more detailed discussion of helicopter site selection is contained in TM 5-251.

*b. Organization and Duties of Helicopter Site Party.*

- (1) *The helicopter site party* consists of the helicopter site operator, the pathfinder control net radio operator, and attached personnel whose chief duties are to reconnoiter, prepare, and mark the helicopter site.
  - (a) *The helicopter site operator* directs the positioning and operation of assembly and navigational aids and the selection, designation, and preparation of landing points for each helicopter. He controls the landings and takeoffs of helicopters and furnishes information to the CC.
  - (b) *The control net radio operator* operates the radio and/or telephone used to maintain communication with the CC and assists the helicopter site operator. He may be provided by the supported unit for attachment to the helicopter site party.
- (2) *Other personnel* may be attached to the helicopter site party to—
  - (a) Assist in the unloading and initial assembly of troops, equipment, and

supplies, and operate assembly aids as directed by the site operator.

- (b) Assist in carrying and installing pathfinder equipment and remove or mark obstacles at landing and assembly points.

*c. Operation at the Helicopter Site.*

- (1) The control net radio operator opens his radio in the pathfinder net as soon as he lands. He carries the radio at all times in order to maintain communication with the CC.
- (2) The helicopter site operator determines the direction of landing immediately upon his arrival and transmits this information to the CC as promptly as possible. He selects and marks the exact landing point for the lead helicopter. Marking panels are placed at the right edge of the landing point. If the site is large and free of obstacles, he need not mark the other landing points for a daylight operation. However, if the helicopter site is restricted in area or has numerous ground obstacles, or if the landings are to be made at night, he must select and mark all landing points (fig. 5).
  - (a) It is undesirable for a helicopter to fly directly over another aircraft on the ground; therefore, in an echelon-left landing formation, the panel or light for the first helicopter must be the farthest forward and to the right (fig. 5). Whether the aids are arranged for landing in flight in line or trail formation depends upon available landing space, number and types of obstacles, and prearranged flight formations. Landings on line are preferable because this procedure eliminates danger of overshooting the landing point and colliding with a parked helicopter (fig. 2 — helicopter site black). When helicopters are to land in trail formation, the landing points should be staggered laterally (fig.

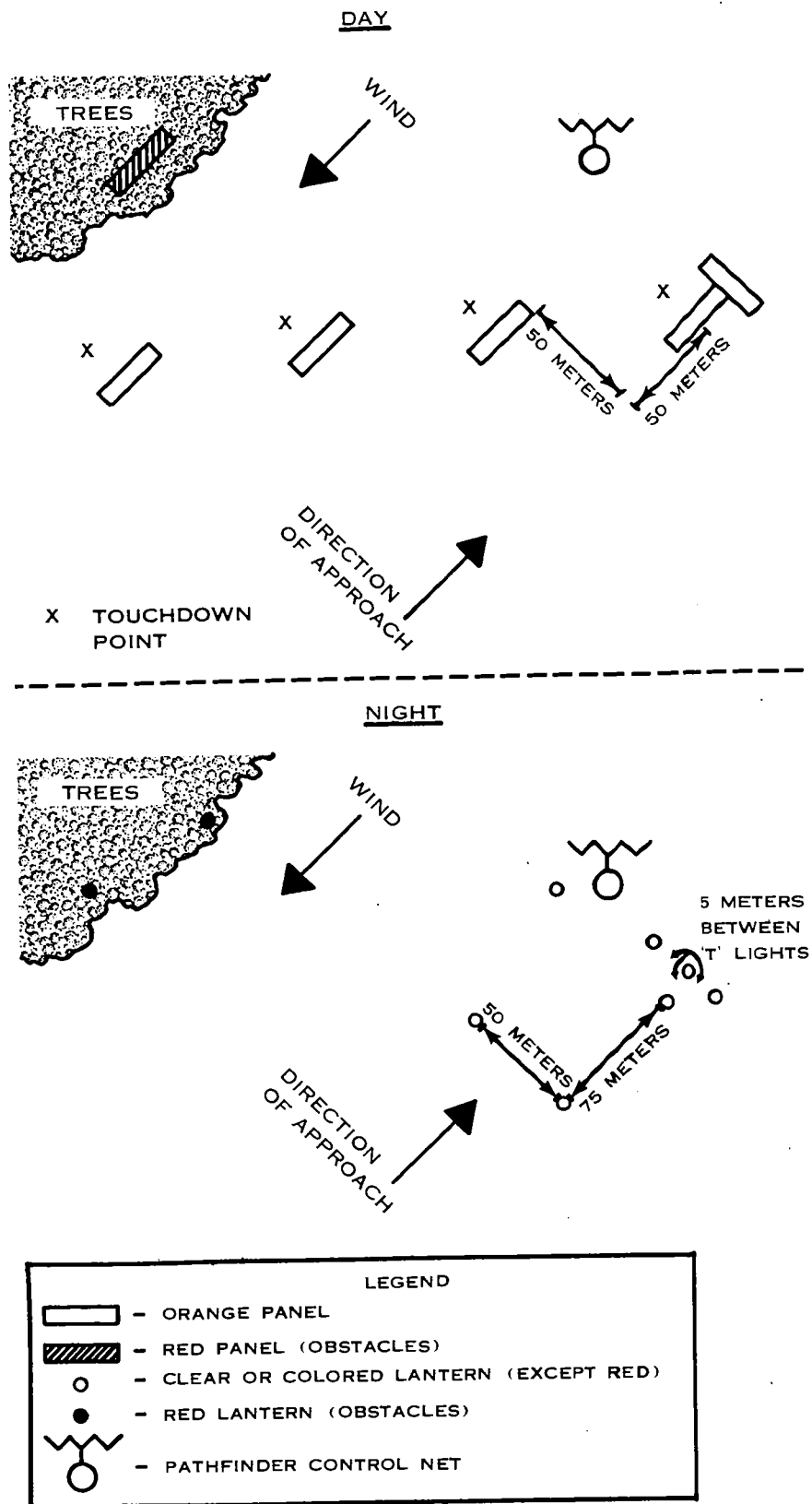


Figure 5. Helicopter landing site (schematic).

2—helicopter site yellow) to reduce the danger of collision, especially at night.

- (b) Panels are the best means of marking landing points for day operations (fig. 5). A panel is placed on the right edge of a desired landing point. An area 50 meters in diameter to the left of the panel is reconnoitered and prepared for landing. The aviator should land just to the left of the panel with the long axis of the helicopter parallel to the long axis of the panel. All panels must be secured to the ground so rotor wash cannot blow them loose. Pilots should be cautioned to avoid overflying panels while landing or taking off.
- (c) Lanterns are used to mark landing points and indicate the direction of landing for a night operation (fig. 5). Lights of different colors may be used to designate different helicopter sites. T lanterns indicate the flight leader's landing point and the direction of approach. Helicopters land with the right landing gear just to the left of the lantern. All lights should be secured to the ground to prevent them from being blown or knocked over. They must be beamed in the direction from which the helicopters approach.
- (3) After selecting the landing sites, pathfinders immediately reconnoiter and prepare the landing points ((b) (b) above). They make hasty improvements at the landing points by removing brush and filling holes, etc. They remove obstacles from approach and departure paths and mark them with red panels or red lights or both. Improvement of the site should be continued as long as necessary.

- (4) Pathfinders mark initial assembly points for troops, equipment, and supplies. These points are located to facilitate assembly so the helicopter site is cleared quickly and easily. If unit assembly areas are to be used, they are preselected by the ground unit commander. Supported ground unit personnel accompanying the pathfinders mark the unit assembly areas, establish assembly aids, act as guides, and assist in unloading operations to insure rapid clearance of personnel, supplies, and equipment from the immediate vicinity of the landing points.
- (5) Security personnel move to their assigned locations and take up firing positions, or they may assist pathfinders in establishing the site.

### 30. Operation of the Helicopter Landing Zone

a. Helicopters approach the landing zone along a designated flight route. They are normally organized into serials containing one or more flights. One serial may contain a flight for each helicopter site. Subsequent flights or serials follow at time intervals which will allow CC personnel and pathfinders at the helicopter sites to properly control landings. Landings of successive flights at one helicopter site should be separated by a minimum of 1 minute in daylight and 2 minutes at night.

b. As each helicopter serial reaches the communications checkpoint on the flight route, the serial leader initiates communication with the CC. The CC then furnishes the serial with information concerning the vector, enemy situation, wind direction and velocity, landing site azimuth, landing direction, landing clearance, and any other information required. Radio messages between the CC and a serial containing four flights, with all pilots monitoring, might be as follows:

| <i>Speaker</i>      | <i>Topic</i>             | <i>Message</i>                                                          |
|---------------------|--------------------------|-------------------------------------------------------------------------|
| Serial leader ..... | Identification, location | HOTEL CONTROL, THIS IS HAWK<br>AT COMMUNICATIONS CHECK-<br>POINT, OVER. |



| <i>Speaker</i>                   | <i>Topic</i>                                       | <i>Message</i>                                                                                                                                                                                                         |
|----------------------------------|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pathfinder at drop/loading zone. | Acknowledgment .....                               | HAWK, THIS IS HOTEL CONTROL: VECTOR, TWO EIGHT ZERO;                                                                                                                                                                   |
|                                  | Vector from air control point to RP.               |                                                                                                                                                                                                                        |
|                                  | Enemy situation .....                              | ENEMY MACHINEGUN VICINITY THREE NINE SIX EIGHT FOUR TWO;                                                                                                                                                               |
|                                  | Wind direction, velocity....                       | WIND NORTHWEST AT ONE FIVE;                                                                                                                                                                                            |
|                                  | Landing site azimuth (from RP to helicopter site). | HAWK ONE: SITE AZIMUTH TWO EIGHT ZERO; LAND VIOLET; THREE THREE ZERO.                                                                                                                                                  |
|                                  | Land azimuth (direction of landing at site).       | HAWK TWO: SITE AZIMUTH TWO NINE ZERO, LAND YELLOW, THREE THREE ZERO.<br>HAWK THREE: SITE AZIMUTH TWO NINE FIVE, LAND GREEN, THREE THREE FIVE.<br>HAWK FOUR: SITE AZIMUTH THREE THREE ZERO, LAND WHITE, TWO SEVEN ZERO. |
|                                  | Final clearance .....                              | CLEAR TO LAND, OVER.                                                                                                                                                                                                   |
| Serial leader .....              | Acknowledgment .....                               | THIS IS HAWK; ROGER; OUT.                                                                                                                                                                                              |

c. While the ground-to-air net radio operator is exchanging messages with the serial leader, the pathfinder control net radio operator at the CC contacts the involved helicopter sites to inform them that flights are approaching and to instruct them to display navigational aids or take other appropriate action.

*Note.* When any or all alternate helicopter sites are used, it may be necessary to move the CC to maintain pathfinder control net radio communication with all sites.

d. The helicopter formation continues along the flight route to the RP. Pilots are assisted by the electronic and visual navigational aids of the RP. All helicopters pass over or near the RP, and each flight moves directly to its assigned landing site. The CC furnishes assistance to any flight which cannot locate its site.

- (1) For a daylight operation, a specified smoke color may be assigned to each helicopter site to aid identification. Since the number of smoke colors is limited, the same color may have to be used by more than one helicopter site. Sites that use the same color should be located farthest apart.

- (a) When smoke is used, care must be taken to avoid starting fires or masking the landing points.

- (b) Smoke should be employed sparingly because it distinctly marks a location not only for friendly forces, but for enemy observers as well. Generally, smoke is used only on orders from the CC in response to an aviator's request for help in identifying his helicopter site.

- (2) For a night operation, pyrotechnics are used instead of smoke. Red signals should be used only to mean DO NOT LAND or to indicate other emergency conditions. Emergency codes should be included in SOP's.

e. Each flight lands at its assigned helicopter site in the manner indicated by CC messages and visual aids displayed.

f. Pathfinders may use arm-and-hand signals (FM 21-60) to help control landings in day or night operations (baton flashlights are used at night).

## CHAPTER 5

### OPERATION OF A FIXED-WING LANDING ZONE

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#### 31. General

A fixed-wing landing zone has one or more landing strips. A landing strip may have a parking area, a taxiway, and a dispersal area.

#### 32. Detachment Organization and Duties

To operate a fixed-wing landing zone, the pathfinder detachment is organized into two basic parties: the CC party and parking party.

*a. CC and RP.* A CC is required at each landing strip. If a pathfinder detachment operates more than one strip, the primary CC is located at the most important strip. An RP is not required; however, one may be used if the detachment operates more than one landing facility. The CC and RP are organized and operated as described in paragraphs 25, 26, and 27.

*b. Parking Party.* The parking party reconnoiters, prepares, and marks the landing strip, taxiways, parking areas, and dispersal areas. It provides parking and taxi signals for each airplane and maintains ground communication with the CC. Using visual aids, it makes the initial assembly points for troops, and furnishes limited security. The basic organization of the parking party includes—

- (1) *The parking party commander* who directs the reconnaissance, preparation, and marking of the landing strip, taxiways, and individual parking and dispersal points for each airplane. He controls the parking and taxiing of airplanes; initial assembly of troops, equipment, and supplies; and furnishes information to the CC.
- (2) *Signalmen* who aid in emplacing and operating visual navigational aids and control the movement of aircraft on the ground.

(3) *Additional personnel* who may be attached to the parking party, as required, to—

- (a) Assist in the unloading and initial assembly of troops, equipment, and supplies, and to operate assembly aids as directed by the parking party commander.
- (b) Assist in preparing runways, taxiways, parking areas, and assembly points by removing or marking obstacles.
- (c) Defend the area against attack and render other assistance as directed.

#### 33. Selection of Fixed-Wing Landing Facilities

*a. Landing Strip.* Factors involved in the selection of aircraft landing facilities are discussed in detail in TM 5-251.

- (1) The surfaces of a landing strip must be smooth enough to permit aircraft to takeoff and land without damage, and the ground must be firm enough to permit loaded planes to land, taxi, and takeoff without bogging down.
- (2) The minimum length and width requirements of a landing strip depend upon the type of aircraft used, the types of loads, the direction and velocity of the wind, and the condition of the ground. Aviation unit and pathfinder detachment commanders coordinate with each other to determine the minimum dimensions of a landing strip. The final decision rests with the aviation unit commander. The following factors affect the required dimensions:
  - (a) A longer landing strip is needed on soft ground than on hard ground.

- (b) Uphill takeoffs and downhill landings require longer landing strips.
- (c) Crosswinds during takeoff and landing are hazardous and require compensatory increases in landing strip length and width.
- (d) The required takeoff distance increases as the mean air density decreases.
- (e) When facilities or available time do not permit removal of obstacles from the approach and departure paths, the sacrifice in usable length of the strip must be considered.

*b. Taxiways.* Taxiways should be prepared on one or both sides of the landing strip so planes can clear the strip immediately after landing. Taxiways must be wide enough to permit the largest aircraft being used to taxi from the departure end of the landing strip to the parking area, then to the approach end of the landing strip, yet leave the landing strip clear for other landings or takeoffs.

*c. Parking Areas and Points.*

- (1) Parking areas are selected where aircraft can load or unload equipment, supplies, or personnel in accordance with a prearranged plan without interfering with the continuous operation of the landing strip. More than one parking area may be needed to provide enough parking points to support the tactical plan. Helicopters should not be permitted to fly or taxi within 50 meters of parked fixed-wing aircraft.
- (2) The exact locations of parking points depend upon ground conditions, obstacles, number and types of aircraft, types of loads, and the tactical plan including dispersion requirements. The points should be located where aircraft can enter and leave without delay. Alternate points should be selected as time permits.

*d. Dispersal Areas.* Dispersal areas are used to park disabled aircraft and other aircraft

scheduled to remain in the area. Dispersal areas should afford concealment from ground and air observation and, where possible should have ground masks between aircraft. More than one dispersal area may be needed to provide the required full extent aircraft dispersion.

### **34. Establishment of Fixed-Wing Landing Facilities**

*a. Landing Strip.*

- (1) The pathfinder control net radios are prepared for operation immediately upon landing. Operators carry their radios at all times in order to maintain constant communication with the CC.
- (2) The parking party reconnoiters the area as soon as it arrives. Following this, the pathfinder commander selects and points out to the parking party the exact landing strip to be used. He designates the center of the long axis or one of the sides of the runway by means of an azimuth or a terrain feature. The parking party then marks the landing strip with visual aids. For day operations, the strip is marked with signal panels; for night operations, it is marked with lanterns (fig. 6). Generally, marking tasks can be performed simultaneously. If a marking priority is required, it is established in this order: approach end, departure end, left side and right side.
- (3) Concurrently with marking, the parking party makes hasty improvements by filling holes or removing brush on the landing strip. It also removes or marks obstacles in the approach and departure paths as promptly as possible.
- (4) All pathfinders should be careful not to create obstacles in the erection of antennas and the construction of field fortifications. They should keep equipment clear of the landing strip so it will not obstruct approach and departure paths or distract the aviators.

*b. Taxiways, Parking Areas, and Dispersal Areas.* The taxiways, parking areas, and dispersal areas are prepared in locations designated by the pathfinder detachment commander. The parking party may prepare these areas simultaneously with preparation of the landing strip. It removes or marks obstacles and continues to improve the facilities as long as necessary.

- (1) Since pilot seats are on the left side of aircraft, the left edge of the taxiway is outlined with panels (lanterns) which should face aviators as they taxi their aircraft.
- (2) A parking point for each aircraft may be marked with a panel (lantern). The aviator should park his aircraft to the right of his panel (lantern) and within wing length of it. Parking arrangements should be preplanned and coordinated.

### 35. Operation of Fixed-Wing Landing Zone

#### *a. General.*

- (1) The CC pathfinder control net operator records flight arrival and departure times and the types of loads brought in or evacuated. The radio operator in the parking area transmits the load data to the CC.
- (2) Landings and takeoffs by large numbers of aircraft present difficult control problems for pathfinders. Radio discipline must be strictly observed to prevent interference with the ex-

change of messages between the CC and flight leaders. The CC must exercise the necessary control over aviators and signalmen; but, in doing so, it must avoid transmissions of unnecessary and confusing radio messages.

#### *b. Approach.*

- (1) Aircraft, formed as flights, approach the landing strip along a designated flight route. Succeeding flights follow at time intervals based upon the availability of parking space and the time required to land and clear the landing strip. Individual aircraft landings are separated by a minimum of 30 seconds during day and 1 minute during night operations. When departures are interspersed with landings, arriving aircraft should land at intervals separated by a minimum of 2 minutes.
- (2) As each flight reaches the communications checkpoint, the flight leader initiates communication with the CC by stating the flight's location, number of aircraft, and types of loads. The CC then provides the aviators with information on the enemy situation, wind direction and velocity, field elevation, direction of landing, and other matters as necessary. The flight leader acknowledges the message and, if not preplanned, assigns the landing order of aircraft within the flight. He issues other instructions to aviators as necessary. Radio messages between the CC and the flight leader (all monitoring) might be as follows:

| <i>Speaker</i>                   | <i>Topic</i>                                                     | <i>Message</i>                                                                |
|----------------------------------|------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Flight leader .....              | Identification, location                                         | PATHFINDER, THIS IS HAWK ONE AT COMMUNICATIONS CHECKPOINT; SIX CARIBOU; OVER. |
| Pathfinder at drop/landing zone. | Acknowledgment                                                   | HAWK ONE, THIS IS PATHFINDER; VECTOR, ONE FIVE ZERO;                          |
|                                  | Vector from control point to landing strip or RP, as applicable. |                                                                               |

*Speaker*

*Topic*

*Message*

|                                                                        |                                                                                                                                |
|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Enemy situation .....                                                  | ENEMY MACHINEGUN VICINITY<br>FOUR EIGHT SEVEN SEVEN<br>FIVE ONE;                                                               |
| Wind direction, velocity....                                           | WIND WEST AT ONE FIVE;                                                                                                         |
| Land direction .....                                                   | LAND, TWO SIX ZERO;                                                                                                            |
| Traffic pattern (given<br>only when traffic is<br>not left-hand).      | TRAFFIC PATTERN (RIGHT)<br>(STRAIGHT IN);                                                                                      |
| Condition of runway .....                                              | SOD RUNWAY;                                                                                                                    |
| Field elevation and other<br>information, i.e.,<br>length, width, etc. | ELEVATION SIX FIVE ZERO;                                                                                                       |
| Call base .....                                                        | CALL BASE; OVER (This instruc-<br>tion tells the flight leader to notify<br>the CC when he commences his turn<br>to base leg.) |
| Flight leader .....Confirmation .....                                  | THIS IS HAWK ONE; ROGER,<br>OUT.                                                                                               |

- (3) The pathfinder control net radio operator at the CC informs the parking party that a flight is approaching.
- (4) The flight formation continues along the flight route to the landing strip (via the RP, if required). If an aircraft or flight cannot locate the landing strip, the CC furnishes additional

assistance on request. When the flight is within sight of the landing strip, it breaks into a tactical landing or other prearranged formation. Each pilot notifies the CC when his aircraft commences its turn to base leg. Messages transmitted might be as follows:

*Speaker*

*Topic*

*Message*

|                                     |                           |                                                      |
|-------------------------------------|---------------------------|------------------------------------------------------|
| Flight leader .....                 | Location .....            | PATHFINDER, THIS IS HAWK ONE:<br>TURNING BASE; OVER. |
| Pathfinder at<br>drop/landing zone. | Acknowledgment .....      | HAWK ONE, THIS IS PATHFINDER;                        |
|                                     | Clearance .....           | CLEAR TO LAND                                        |
|                                     | Parking instruction ..... | RIGHT TURN AT TAXI SIGNAL-<br>MAN; OVER.             |
| Flight leader .....                 | Confirmation .....        | THIS IS HAWK ONE; RIGHT TURN;<br>OUT.                |

*c. Landing.* Each aircraft lands as directed by the CC and the displayed visual aids.

- (1) Visual signals are used in accordance with prearranged plans to assist aviators in routine landings and in emergency situations. If ground-to-air communication fails, landings and takeoffs are controlled by means of visual signals and aids.
- (2) Care must be taken not to blind the aviators with smoke nor confuse them with unnecessary or unusual signals.

- (3) If a dangerous landing situation arises, the pathfinder detachment commander should keep the aircraft in the air until the landing can be accomplished. He instructs the aviators by ground-to-air radio or emergency visual signals.

*d. Parking.* As each aircraft touches down, the parking party assumes control.

- (1) A signalman guides the aviator from the landing strip to the taxiway. The aviator then taxis to the parking area

by guiding on the visual aids displayed. On exceptionally poor or unmarked taxiways, it may be necessary for a signalman to lead each aircraft to its parking area.

- (2) As each aircraft enters the parking area, a signalman directs it to its designated parking point.
- (3) All parking, taxi, and arm-and-hand signals (FM 21-60) must be clearly visible (at night, baton flashlights are used) and understandable to aviators. These signals are given from the left side of aircraft. Signalmen must be positioned far enough from the planes to be in view of the aviators.
- (4) When an aircraft has parked, supporting unit personnel attached to the pathfinder detachment take charge of the unloading and initial assembly of the transported troops, equipment, and supplies. Movement and assembly must be performed rapidly and in such a manner that the landing strip,

taxiways, or parking points will not be blocked. Movement across the landing strip is not permitted without specific approval of the CC.

- (5) Disabled aircraft and aircraft unable to leave on schedule are moved to a dispersal area.

*e. Departing.* When aircraft are ready to depart, the parking party control net radio operator notifies the CC. A departure may be made in a full flight formation, in a portion of a flight formation, or by individual aircraft depending upon the plan and the existing situation. A signalman guides the aircraft out of the parking area and onto the taxiway in the order designated by the CC. A signalman on the taxiway keeps the aircraft there until the runway is clear. The aircraft are then released one at a time as follows: the CC gives each aviator clearance through the ground-to-air radio, the aviator notifies the signalman by hand signals that he has been cleared, and the signalman then releases the aviator to enter the runway. Message sequence should be as follows:

| <i>Speaker</i>        | <i>Topic</i>              | <i>Message</i>                                                                             |
|-----------------------|---------------------------|--------------------------------------------------------------------------------------------|
| Pathfinder at CC..... | Identification .....      | HAWK ONE, THIS IS PATHFINDER;                                                              |
|                       | Taxiing instructions .... | WIND WEST AT EIGHT; CLEAR TO TAXI;                                                         |
|                       | Takeoff instruction ..... | TAKEOFF TWO SIX ZERO; OVER.                                                                |
| Flight leader .....   | Confirmation .....        | PATHFINDER, THIS IS HAWK ONE; TAXIING FOR TAKEOFF, TWO SIX ZERO; WIND WEST AT EIGHT; OVER. |
| Pathfinder at CC..... | Clearance .....           | HAWK ONE, THIS IS PATHFINDER; CLEAR FOR TAKEOFF.                                           |

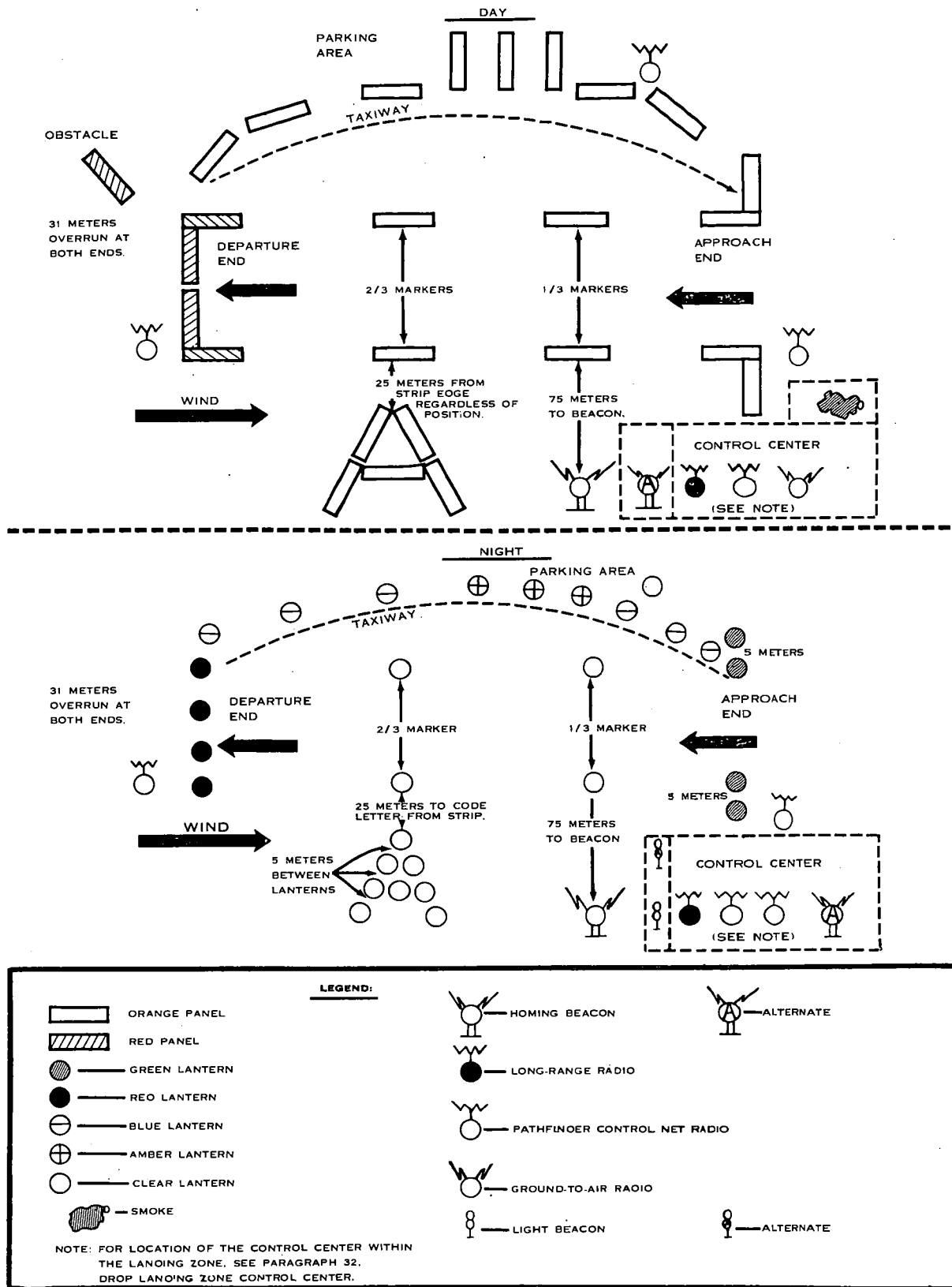


Figure 6. Fixed-wing landing zone.

## CHAPTER 6

### DROP ZONES

#### 36. General

A drop zone is a specified location where troops or material are air-delivered. It has a CC and one or more drop sites. The CC may be established at or near the T location, and the CC party may assume the duties of the T party. If two drop sites are established, each must have a CC, with the primary CC located at the most critical drop site. Normally, when only one drop site is used, an RP is not employed; but when a single drop site is operated in conjunction with any number of helicopter sites, employment of an RP is desirable (fig. 2).

#### 37. Detachment Organization and Duties

a. The pathfinder detachment at a drop zone is organized into a CC party and a DZ party. The DZ party is further subdivided into a T party, a flank party, and a far party. The T party prepares and places the panels (lanterns) that form the T; the flank and far parties position the flank panels (lanterns) and far panels (beacons), respectively (fig. 6), and provide limited security.

b. The CC and RP are organized and operated as described in paragraphs 25, 26, and 27.

#### 38. Selection of Drop Zone

a. A drop zone is located where it can best support the tactical plan. Factors to be considered in its selection are the—

- (1) Type aircraft to be employed.
- (2) Altitude at which air-delivery is to be made.
- (3) Aircraft formation for air-delivery.
- (4) Types of loads to be delivered.
- (5) Relative number of obstacles in the area.
- (6) Availability of adequate aircraft approach and departure routes.

(7) Method of airdrop, i.e., free fall, high velocity, or low velocity.

(8) Access to the area.

b. The required length of a drop zone can be computed by using the ground speed of the aircraft and the time needed to release its cargo. The formula is  $D = RT$ , in which  $D$  is the zone length (distance) in meters,  $R$  is the ground speed (rate) of the aircraft in meters per second, and  $T$  is the time required for an aircraft to release its cargo. To use this formula, air speed (expressed in knots) must first be converted to ground speed (expressed in meters) per second.

*Note.* When the wind velocity at the delivery altitude cannot be determined, use the aircraft's air speed as the ground speed.

- (1) To compute the ground speed when an aircraft is flying into a headwind, subtract the velocity of the headwind from the air speed. For example, an aircraft flying into a 10-knot headwind at an indicated air speed of 110 knots will have a ground speed of 100 knots. (Crosswinds have a negligible effect on ground speed; therefore, they need not be considered.) To compute the ground speed when an aircraft is flying with a tailwind, add the velocity of the tailwind to the air speed. For example, a 10-knot tailwind plus a 110-knot air speed gives a ground speed of 120 knots.

*Note.* It is desirable to fly aircraft into the wind during air-delivery because the slower ground speed gives more time over the zone and assures a more compact ground pattern.

- (2) To convert knots to meters per second, use this equation: 1 knot equals .51 meters per second. Thus, a ground



speed of 100 knots equals  $.51 \times 100$  equals 51 meters per second.

- (3) To calculate the required length of a *DZ* by using the formula  $D$  equals  $RT$  and applying the conversions described in (1) and (2) above, proceed as in this example: An aircraft is flying at a ground speed of 90 knots, and its cargo can be released in 8 seconds. What is the required length of the *DZ*?

$R$  equals 45.9 meters per second ( $.51 \times 90$  equals 45.9).

$T$  equals 8 seconds.

$D$  equals  $45.9 \times 8$  equals 367.2 meters (rounded off to 368 M).

c. If a *DZ* of the desired length is not available, the flight time over the zone (whatever its length) must be computed to determine how much of the load can be released in one pass and/or how many passes must be made to release the entire load. This formula is used:  $T$  equals  $D/R$ , in which  $T$  is the time over the *DZ*,  $D$  is the length (distance) of the *DZ*, and  $R$  is the ground speed (rate). For example, a field 150 meters long is available as a *DZ*, and an aircraft can release its load at a ground speed of 105 knots or 54 meters per second ( $.51 \times 105$  equals 53.55 or 54). Applying the formula  $T$  equals  $D/R$ ,  $150 \div 54$  equals 2.7 seconds (time over the *DZ*).

d. The required width of the *DZ* depends upon the aircraft formation used. For example, a single aircraft can drop its load in a zone no wider than the aircraft, but a Vee of U-1's would need a zone at least 80 meters wide.

### 39. Selection of T Location

a. *General.* The location of the *T* depends upon the size and shape of the *DZ*; the formation, ground speed, and altitude of the aircraft over the *DZ*; the number of containers to be delivered and the time required to drop them; and the drift of parachuted loads which, in turn, depends upon the direction and velocity of the wind. The *T* is alined with the stem parallel to the long axis of the *DZ* or on a pre-

arranged azimuth. The aircraft fly up the stem of the *T* and begin releasing their loads as they cross the junction of the stem and crossbar.

b. *Wind Drift Formula.* The wind drift formula,  $D$  equals  $KAV$ , is used to determine the amount of drift of parachutes (in meters) from a given altitude. In this formula,  $K$  is a constant that represents the characteristic drift of a parachute of a certain model (for T-10 parachutes,  $K$  is 4.1; for all other parachutes,  $K$  is 2.6),  $A$  is the altitude of the aircraft (in hundreds of feet) over the *DZ*, and  $V$  is the ground velocity (in knots) of the wind.

- (1) An anemometer can be used to measure wind velocity. Some anemometers give readings in knots, and others in miles per hour. Miles per hour is multiplied by .86 to convert to knots, but, for practical purposes, the direct substitution of miles per hour for knots in the wind drift formula gives sufficiently accurate results for winds below 10 knots.
- (2) Since each pathfinder will not always have an anemometer available, he must be able to estimate wind velocity with acceptable accuracy. Pathfinders can learn to do this during training by observing the effect of winds of varying strengths on grass, dust, bushes, or small pieces of paper, and then comparing these effects with those associated with anemometer readings.
- (3) To illustrate how the wind drift formula  $D$  equals  $KAV$  is applied, assume that G-13 parachutes are used to drop cargo from an altitude of 500 feet in a 10-knot wind. Then,  $2.89 \times 5 \times 10$  equals 144.50 or 145 meters of drift.

### 40. Establishment of Drop Zone

a. *Day Drop Zone* (fig. 7).

- (1) The pathfinder *CO* selects the exact location for the *T*. He then has the stem of the *T* alined on the predesignated heading which he desires the

aircraft to fly, and supervises the placement of the center or base panel of the crossbar.

- (a) The T party places the two panels in the stem of the T (leaving a space two panels long between them) and between the base panel and the stem panel next to it. The party then places the two additional crossbar panels perpendicular to the line of the stem and alined with the base panel.
  - (b) The flank party places a flank panel at the left limit of the *DZ*, parallel to the stem of the T, alining the center of the panel with the crossbar. The flank panel is placed at a distance of 200 meters from the left edge of the left panel of the T crossbar.
  - (c) The far party places a panel at the far end of the *DZ*, erecting it vertically on a tree or bush so it is parallel to the desired line of flight, is in line with the stem of the T, and is positioned at a maximum distance of 500 meters or the length of the drop zone, whichever is less.
- (2) Concurrently, the CC party prepares the ground-to-air radio and electronic homing beacons for operation. All electronic aids must be sufficiently dispersed to prevent mutual electronic interference or simultaneous loss by enemy fire.

*b. Night Drop Zone (fig. 7).* The procedure for establishing a night *DZ* is the same as for a day *DZ* except that either infrared or incandescent lights are used to mark the T, the flank, and the far end. The interval between lights in the T is 25 meters. One beacon light serves as the end light in the stem of the T, and another replaces the far panel. The beacon heads are coded at 180° and 0° respectively. If only one beacon light is available, a lantern is used to mark the far end. The far light or beacon is positioned in the same manner as the far panel.

c. In heavily vegetated terrain, *DZ*'s are difficult to locate from the air. Expedient methods such as the use of balloons, pyrotechnics, and signal pistols may be used effectively when operating on such terrain.

#### 41. Operation of a Drop Zone

a. As each flight reaches the communication checkpoint, the flight or serial leader informs the CC and includes additional information (as necessary) concerning the number and type(s) of aircraft, types of loads, etc. The CC provides the aviators with information on the magnetic heading (vector) from the communications checkpoint to either the *DZ* or the RP, on the enemy situation, on aircraft formation and drop altitude, on map elevation of the highest point of the *DZ*, and on any other matters as necessary. The pathfinder in command must carefully examine the map of the area and the actual topographical surroundings in the zone to insure that there are no obstacles in the flight path on either the approach or immediate departure route. The elevation prescribed for the aviators by the CC must be high enough to guarantee adequate clearance of all obstacles in the flight path. The flight leader acknowledges receipt of the message and complies with the instructions received.

b. As the lead aircraft comes into view, the CC gives the aviator verbal instructions to guide him into the stem of the T, alerts him as he nears it, and tells him when to release his load. Trailing aircraft or other aircraft in the same formation follow the movements of the lead aircraft as closely as possible and listen for corrective instructions from the CC. The CC prefaces individual instructions with the call sign of the aircraft concerned.

c. In an extremely restricted *DZ*, it may be necessary for each aircraft to make several passes over it, releasing a part of its load on each pass (par. 38c). In such a *DZ*, the best formation is single aircraft in trail. The CC has the flight head up the stem of the T and over the *DZ* in a continuous circle, using either right- or left-hand traffic. Since the aviators of aircraft in trail can usually follow the lead aircraft quite accurately, the CC seldom has to

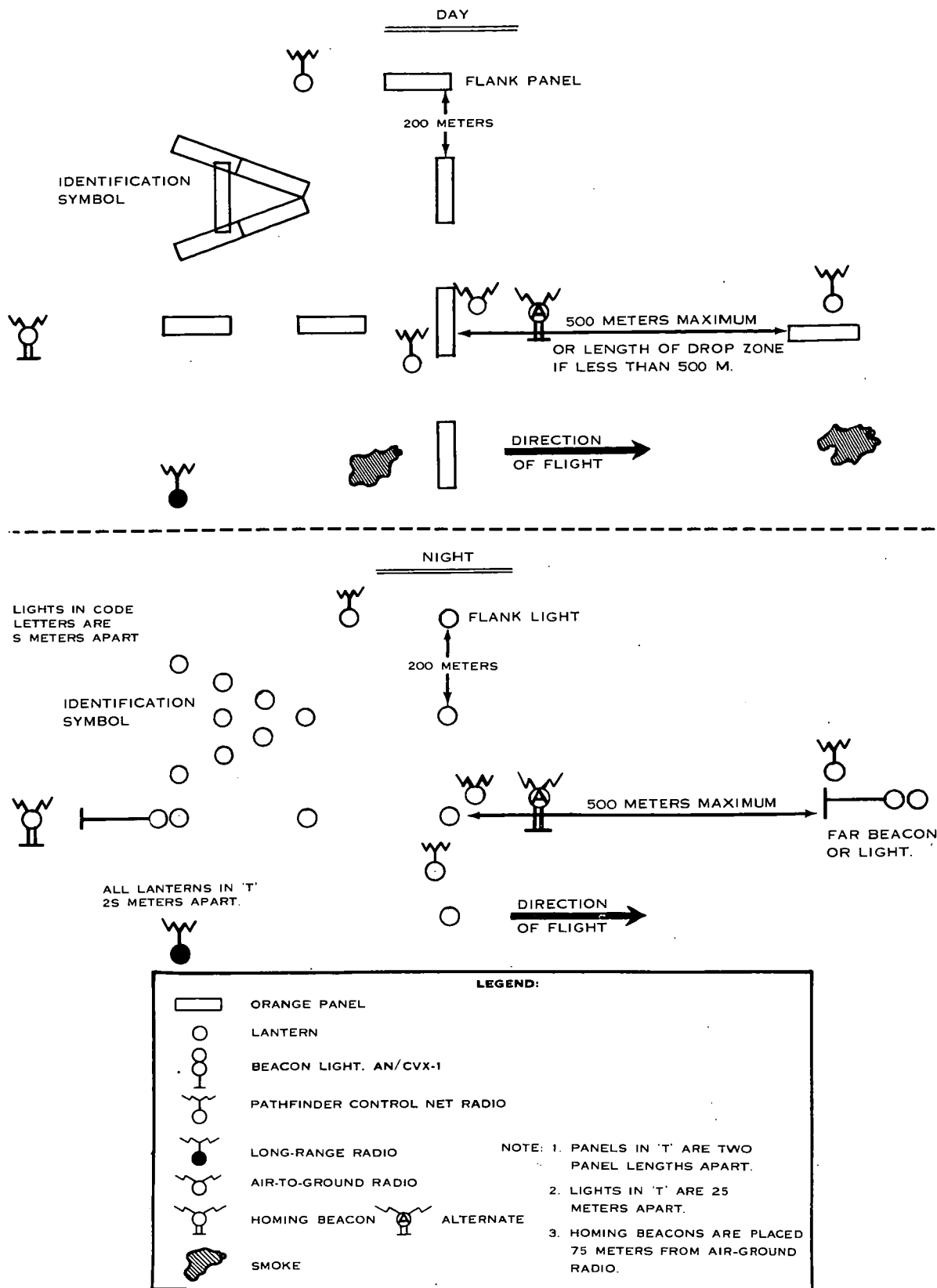


Figure 7. Drop zone.

give them individual instructions until each aircraft is in position to drop its load.

d. Aircraft in Vee formation are not as maneuverable as single aircraft in trail. For this reason, pathfinders must anticipate the additional space required by aviators of such aircraft to complete the corrective maneuvers, and the CC must give instructions for turns while the aircraft are still far enough away for the aviators to make gradual directional changes.

## 42. Examples of Pathfinder Guidance Procedure

### a. General.

- (1) When the aircraft come into view of the CC pathfinder, he must keep them under constant observation in order to guide them correctly over the *DZ*. The aircraft must be flying high enough to give the pathfinder a continuous line of sight to them. The pathfinder may have to instruct the aviators to change altitude to insure this.
- (2) Initially, the pathfinder gives instructions only to the serial or flight leader, but all aviators in the serial or flight monitor the messages and imitate the action of their leader. When the pathfinder needs to give instructions to individual aviators, he prefaces his instructions with the call sign of the aircraft concerned.
- (3) If ground-to-air radio communication fails while the CC is providing guidance, all aviators continue their missions, using visual aids on the ground to assist in making the correct approach. In such situations they release their loads as their aircraft pass over the junction of the stem and crossbar of the T.

b. *Guidance for a Drop in Trail.* Guidance communication for a drop in trail might be as follows:

Flight leader: PATHFINDER, THIS IS HAWK ONE WITH SIX CARIBOU

AT COMMUNICATIONS CHECK-POINT; OVER.

Pathfinder: HAWK ONE, THIS IS PATHFINDER; VECTOR, ZERO FOUR FIVE; ENEMY MACHINEGUN VICINITY TWO EIGHT FOUR SEVEN ONE THREE: DROP IN TRAIL AT TWO HUNDRED ACTUAL (gives *DZ* magnetic heading if flight is routed first to RP): FIELD ELEVATION, SIX FIVE ZERO; MAINTAIN FIVE HUNDRED (number of feet) UNTIL I HAVE YOU IN SIGHT; OVER.

Flight leader: THIS IS HAWK ONE, ROGER, OUT.

Pathfinder: (Later, to change flight altitude) HAWK ONE, THIS IS PATHFINDER, DESCEND TO TWO HUNDRED; OVER.

Flight leader: THIS IS HAWK ONE, ROGER; OUT.

c. *Guidance for Drop in Vees.* Guidance communication for a drop in Vees might be as follows:

Flight leader: PATHFINDER, THIS IS DOVE ONE WITH SIX CARIBOU AT TWO ONE ONE SIX FIVE TWO; OVER.

Pathfinder: DOVE ONE, THIS IS PATHFINDER; VECTOR, ZERO SIX ZERO; ENEMY SITUATION NEGATIVE; DROP IN VEEs AT TWO HUNDRED ACTUAL; FIELD ELEVATION, SEVEN SIX ZERO; OVER.

Flight leader: THIS IS DOVE; ROGER; OUT.

As the lead Vee comes into sight, the pathfinder guides it toward the T with the second Vee following. When he first sights the lead aircraft, he may have to give instructions such as the following:

Pathfinder: DOVE ONE, STEER RIGHT. The flight leader responds by performing the action directed by the pathfinder. When the flight leader is on the desired course, the pathfinder informs him:

Pathfinder: DOVE ONE, ON COURSE. The flight leader straightens out to fly on the heading indicated at the time the pathfinder announces "ON COURSE." Since all aircraft should change direction *gradually*, the pathfinder must begin giving his instructions before the aircraft reaches the point of change. If, however, an abrupt turn is necessary, the pathfinder stresses the need as follows:

Pathfinder: DOVE ONE, STEER HARD LEFT.

The flight leader turns as sharply as safety considerations permit and continues in this direction until the pathfinder gives his next instruction as follows:

Pathfinder: DOVE ONE, ON COURSE. (He alerts the flight leader as he nears the T.) DOVE ONE, STAND BY. (The flight leader prepares to execute air delivery. As he passes over the T, the pathfinder instructs him to start air delivery.) DOVE ONE, EXECUTE! EXECUTE! EXECUTE! (The flight lead-

er, followed by all other aircraft in his formation, executes the air delivery. He maintains his heading until he clears the DZ. He then leads his flight formation to the control point and/or the departure airfield. Should the aircraft veer off the desired course during the drop, further steering correction commands can be given.)

If the pathfinder sees that an aircraft is not in correct position to make the air delivery, he must warn the pilot and instruct him further:

Pathfinder: DOVE TWO, NO DROP! NO DROP! NO DROP!

Dove Two: DOVE TWO, NO DROP.

Pathfinder: DOVE TWO, MAKE RIGHT TURN, FOLLOW DOVE SIX.

Dove Two makes a right turn and follows the last aircraft in the flight to make a second pass over the DZ. The command to execute is repeated until the drop commences, unless conditions again preclude making the drop.

# APPENDIX I

## REFERENCES

|           |                                                                                  |                   |                                                                                                                                                                                                                                                                                                                                                                           |
|-----------|----------------------------------------------------------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AR 320-5  | Dictionary of United States Army Terms.                                          | FM 31-21          | Guerrilla Warfare and Special Forces Operations.                                                                                                                                                                                                                                                                                                                          |
| AR 320-50 | Authorized Abbreviations and Brevity Codes.                                      | (CM)FM 32-5       | Communications Security (U).                                                                                                                                                                                                                                                                                                                                              |
| JCS Pub 1 | Dictionary of United States Military Terms for Joint Usage.                      | FM 57-10          | Army Forces in Joint Airborne Operations.                                                                                                                                                                                                                                                                                                                                 |
| FM 1-5    | Army Aviation; Organizations and Employment.                                     | FM 57-17          | Airborne Division, Cavalry Troop.                                                                                                                                                                                                                                                                                                                                         |
| FM 1-15   | Aviation Battalion, Infantry, Airborne, Mechanized and Armored Divisions.        | FM 57-35          | Airmobile Operations.                                                                                                                                                                                                                                                                                                                                                     |
| FM 1-100  | Army Aviation.                                                                   | FM 57-100         | The Airborne Division.                                                                                                                                                                                                                                                                                                                                                    |
| FM 5-15   | Field Fortifications.                                                            | FM 61-100         | The Division.                                                                                                                                                                                                                                                                                                                                                             |
| FM 5-25   | Explosives and Demolitions.                                                      | TM 3-210          | Fallout Prediction.                                                                                                                                                                                                                                                                                                                                                       |
| FM 7-15   | Infantry, Airborne Infantry, and Mechanized Infantry, Rifle Platoons and Squads. | TM 5-251          | Army Airfields and Heliports.                                                                                                                                                                                                                                                                                                                                             |
| FM 7-20   | Infantry, Airborne Infantry, and Mechanized Infantry Battalions.                 | TM 9-1370-200     | Military Pyrotechnics.                                                                                                                                                                                                                                                                                                                                                    |
| FM 7-24   | Communication in Infantry and Airborne Divisions.                                | TM 10-500-Series  | Air Delivery of Supplies and Equipment.                                                                                                                                                                                                                                                                                                                                   |
| FM 7-30   | Infantry, Airborne, and Mechanized Division Brigades.                            | TM 11-287         | Radio Sets AN/VRQ-1, AN/VRQ-2, and AN/VRQ-3.                                                                                                                                                                                                                                                                                                                              |
| FM 7-100  | Infantry Division.                                                               | TM 11-289         | Receiver - Transmitters RT-66/GRC, RT-67/GRC, and RT-68/GRC.                                                                                                                                                                                                                                                                                                              |
| FM 17-100 | The Armored Division and Combat Command.                                         | TM 11-296         | Radio Set AN/PRC-6 Operation and Organizational Maintenance.                                                                                                                                                                                                                                                                                                              |
| FM 20-32  | Land Mine Warfare.                                                               | TM 11-5020        | Antenna Equipment RC-292.                                                                                                                                                                                                                                                                                                                                                 |
| FM 21-5   | Military Training.                                                               | TM 11-5820-292-10 | Operator's Manual: Radio Sets AN/PRC-8, -8A, -9, -9A, -10, -10A, and -28.                                                                                                                                                                                                                                                                                                 |
| FM 21-6   | Techniques of Military Instruction.                                              | TM 11-5820-292-20 | Organizational Maintenance Manual: Radio Sets AN/PRC-8, -8A, -9, -9A, -10, -10A, and -28.                                                                                                                                                                                                                                                                                 |
| FM 21-26  | Map Reading.                                                                     | TM 57-210         | Air Movement of Troops and Equipment.                                                                                                                                                                                                                                                                                                                                     |
| FM 21-30  | Military Symbols.                                                                | TM 57-220         | Technical Training of Parachutists.                                                                                                                                                                                                                                                                                                                                       |
| FM 21-31  | Topographic Symbols.                                                             | ACP 168-(A)       | Pyrotechnic Signals.                                                                                                                                                                                                                                                                                                                                                      |
| FM 21-40  | Small Unit Procedures in Nuclear, Biological, and Chemical Warfare.              | DA Pam 108-1      | Index of Army Motion Pictures, Filmstrips, Slides and Phonorecordings.                                                                                                                                                                                                                                                                                                    |
| FM 21-41  | Soldier's Handbook for Chemical and Biological Operations and Nuclear Warfare.   | DA Pam 310-3      | Military Publications: Index of Doctrinal Training, and Organizational Publications. (Field Manuals, Reserve Officers' Training Corps Manuals, Training Circulars, Army Training Programs, Army Subject Schedules, Army Training Tests, Firing Tables and Trajectory Charts, Tables of Organization and Equipment, Type Tables of Distribution, and Tables of Allowances. |
| FM 21-60  | Visual Signals.                                                                  |                   |                                                                                                                                                                                                                                                                                                                                                                           |
| FM 21-75  | Combat Training of the Individual Soldier and Patrolling.                        |                   |                                                                                                                                                                                                                                                                                                                                                                           |
| FM 24-18  | Field Radio Techniques.                                                          |                   |                                                                                                                                                                                                                                                                                                                                                                           |
| FM 31-11  | Doctrine for Amphibious Operations.                                              |                   |                                                                                                                                                                                                                                                                                                                                                                           |
| FM 31-12  | Army Forces in Amphibious Operations (The Army Landing Force).                   |                   |                                                                                                                                                                                                                                                                                                                                                                           |
| FM 31-13  | Battle Group Landing Team (Amphibious).                                          |                   |                                                                                                                                                                                                                                                                                                                                                                           |

## APPENDIX II

### OPERATION FORMATS

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#### 1. General

The formats described here are used to facilitate organization of the pathfinder detachment for operations, and to maintain an accurate record of personnel and material delivered and evacuated during an operation. These formats are intended as a guide and may be modified as required.

#### 2. Operation Planning Format (fig. 8)

*a. Purpose.* This format is used by the detachment commander in organizing his unit for an operation. It consolidates information pertinent to each individual and can be used as a reference by the commander during his planning and briefing for an operation.

##### *b. Explanation of Headings.*

- (1) *Aircraft number.* The chalk number or the last three digits of the serial number of the aircraft in which the individual will be transported.
- (2) *Exit number.* The order in which the pathfinders will leave the aircraft.
- (3) *Name.* The name of the pathfinder.
- (4) *Position in chain of command.* A number indicating the relative order of rank within the detachment (or within teams); if widely dispersed (i.e., for a helicopter landing zone operation).
- (5) *Duty and location.* The job assignment and location within the landing area for each pathfinder.
- (6) *Call sign and frequency.* The radio call sign and frequency for those individuals operating radios.

- (7) *Equipment.* Equipment, other than individual equipment, that each pathfinder will carry for an operation.

#### 3. Landing/Drop Zone Control Records (fig. 9)

*a. Purpose.* This format is used to maintain a record of aircraft arrivals, departures, and locations in the landing area. It serves as a source of information for both ground and aircraft commanders, aids in accounting for personnel and equipment, and is instrumental in making efficient use of available aircraft. It is normally maintained by the pathfinder command net radio operator at the CC.

##### *b. Explanation of Headings.*

###### (1) *Date/time group.*

- (a) *Pfdr team.* Coded or numbered designation.
- (b) *Supported unit.* Ground unit designation.
- (c) *Period.* Date and time operation commenced until 2400 hours the following day, or 0001 until 2400 hours.
- (d) *Operation.* Special designation or operation plan number.
- (e) *(Helicopter Site) (Landing Site) (DZ) designation.* Cross out items in parentheses not applicable and add special designation given (if any).
- (f) *Recorder.* Name of person who has recorded data on the form.

###### (2) *Column headings.*

- (a) *Flight or aircraft number.* Radio call sign of the flight or aircraft.
- (b) *Type aircraft.* Army or Air Force model designation.

(c) *Time communication established.* Time aircraft acknowledges contact (radio or visual, as applicable).

(d) *Time.*

1. *Arrival.* Time aircraft, or first of flight, sets wheels down.

2. *Departure.* Time aircraft, or last of flight, has wheels up.

(e) *Type load.*

1. *Delivered.* Type supply or equipment, or number of persons delivered.

2. *Evacuated.* Type supply or equipment, or number of persons evacuated.

(f) *Destination.* Aircraft destination within the landing area.

(g) *Remarks.* Indicate specific equipment delivered or evacuated, and amounts. Other pertinent remarks which may assist in correcting communications, field marking techniques, etc., for future operations.

#### PATHFINDER OPERATION PLANNING FORMAT

| Plane No. | Exit No. | Name     | Position in chain of command | Duty and location                                   | Call sign and frequency | Equipment (all PRC-10 with two batteries) |
|-----------|----------|----------|------------------------------|-----------------------------------------------------|-------------------------|-------------------------------------------|
| 998       | 1        | Baker    | 1                            | Det CO<br>CC.                                       | Pfdr<br>Control         | 1 PRC-10/Altn<br>FM Homer.                |
| 998       | 2        | Frost    | 5                            | Air-Ground<br>radiotele-<br>phone oper-<br>ator CC. | Ajax<br>41.6            | 2 PRC-10's.                               |
| 998       | 3        | Thomas   | 9                            | Pfdr net<br>CC.                                     | CC<br>49.5              | 1 PRC-10, 3<br>Yellow, 2 Red<br>Smoke.    |
| 998       | 4        | Bowman   | 14                           | LZ<br>CC.                                           | Hangman<br>51.0         | 1 PRC-10,<br>5 VS-17's.                   |
| 998       | 5        | Hare     | 15                           | Security<br>CC.                                     |                         | RC-292<br>PRC-10.                         |
| 999       | 1        | Chambers | 2                            | XO<br>RP.                                           | 42.0                    | 1 Primary<br>1 Red Smoke FM<br>Homer.     |
| 999       | 2        | Beck     | 6                            | Alternate<br>Air-ground<br>RP.                      |                         | 1 PRC-10<br>1 Red Smoke.                  |
| 999       | 3        | Fry      | 10                           | Pfdr net<br>radiotele-<br>phone<br>operator<br>RP.  | RP<br>49.5              | 5 VS-17's<br>10 Yellow Smoke.             |
| 999       | 4        | Radel    | 13                           | Code letter<br>RP.                                  |                         | 1 PRC-10.                                 |
| 998       | 6        | Bicknell | 3                            | Det Sgt Land-<br>ing Site Blue<br>Operator.         |                         | 8 VS-17's.                                |

Figure 8. Operation planning format.



PATHFINDER OPERATION PLANNING FORMAT—Continued

| Plane No. | Exit No. | Name       | Position in chain of command | Duty and location                        | Call sign and frequency | Equipment (All PRC-10 with two batteries) |
|-----------|----------|------------|------------------------------|------------------------------------------|-------------------------|-------------------------------------------|
| 998       | 7        | Sincere    | 7                            | Landing Site<br>Blue Signalman.          |                         | 5 Yellow<br>1 Red Smoke.                  |
| 998       | 8        | Weekley    | 11                           | Landing Site<br>Blue Radiotelephone Op.  | Blue<br>49.5            | 1 PRC-10.                                 |
| 999       | 5        | Baglioni   | 4                            | Landing Site<br>Green Operator.          |                         | 8 VS-17's.                                |
| 999       | 6        | Richards   | 8                            | Landing Site<br>Green Signalman.         |                         | 5 Yellow<br>1 Red Smoke.                  |
| 999       | 7        | Moat       | 12                           | Landing Site<br>Green Radiotelephone Op. | Green<br>49.5           | 1 PRC-10.                                 |
| 998       | 9        | Benavidez  |                              | Security<br>Landing Site<br>Blue.        |                         |                                           |
| 998       | 10       | Sobasky    |                              | Security<br>Landing Site<br>Blue.        |                         |                                           |
| 999       | 8        | Johnson    |                              | Security<br>Landing Site<br>Green.       |                         |                                           |
| 999       | 9        | Thomlinson |                              | Security<br>Landing Site<br>Green.       |                         |                                           |

Figure 8. Operation planning format—Continued.

Pfdr Det  
Supported Unit  
Period  
Operation  
(Helicopter Site,  
Landing Site, *DZ*)  
Designation  
Recorder

187  
1/29 Inf  
210001-212400 May 62  
YELLOW JACKET  
BRAVO

SFC G. E. Turner

| Flight<br>or Air-<br>craft<br>No.       | Type<br>Acft | Time<br>Comm<br>Estab-<br>lished | Time |      | Type Load                                                          |      | Destination<br>(Helicopter<br>Site, Landing<br>Site, or DZ) | Remarks                                              |
|-----------------------------------------|--------------|----------------------------------|------|------|--------------------------------------------------------------------|------|-------------------------------------------------------------|------------------------------------------------------|
|                                         |              |                                  | Arr  | Dprt | Delivered                                                          | Evac |                                                             |                                                      |
| (Example for Landing Strip Operation)   |              |                                  |      |      |                                                                    |      |                                                             |                                                      |
| Mike 1                                  | CV-2         | 0600                             | 0620 | 0625 | 75 cases<br>rats                                                   | 2WIA | Alfa White                                                  |                                                      |
| Mike 2                                  | CV-2         | 0600                             | 0620 | 0625 | 40 cases<br>rats and<br>ammo, 8/<br>clip                           | 2WIA | Alfa White                                                  | Damaged<br>propel-<br>ler. To<br>disper-<br>sal area |
| Mike 3                                  | CV-2         | 0600                             | 0620 | 0625 | 10 cases<br>rats,<br>3.5 RL<br>and cal.<br>7.62-mm<br>20/magazines | 3WIA | Alfa White                                                  |                                                      |
| (Example for Drop Zone Operation)       |              |                                  |      |      |                                                                    |      |                                                             |                                                      |
| Red 1                                   | CY-2         | 1705                             | 1720 |      | 7.62-mm<br>20/magazines<br>and linked                              |      | Echo Yellow                                                 |                                                      |
| Red 2                                   | CV-2         | 1705                             | 1720 |      | Unk                                                                |      | Echo Yellow                                                 | Aborted<br>one mile<br>out                           |
| Red 3                                   | CV-2         | 1705                             | 1720 |      | 60 cans water                                                      |      | Echo Yellow                                                 |                                                      |
| 3564                                    | CH-34        | 1720                             | 1740 |      | 75 cases rats                                                      |      | Echo Blue                                                   | Four<br>broken<br>cases                              |
| (Example for Helicopter Site Operation) |              |                                  |      |      |                                                                    |      |                                                             |                                                      |
| Violet 1                                | CH-34        | 1215                             | 1225 | 1226 | 9 pers                                                             |      | Hotel Green                                                 |                                                      |
| Violet 2                                | CH-34        | 1215                             | 1225 | 1226 | 9 pers                                                             |      | Hotel Green                                                 | Radio<br>doesn't<br>receive                          |
| Violet 3                                | CH-34        | 1215                             | 1225 | 1226 | ¼-ton trk                                                          |      | Hotel Green                                                 |                                                      |
| Violet 4                                | CH-34        | 1215                             | 1225 | 1230 | 9 pers                                                             | 4WIA | Hotel Green                                                 |                                                      |

Figure 9. Landing/drop zone control record (sample extract).

### APPENDIX III

## CHECKLIST FOR PATHFINDER OPERATION

---

Upon receipt of an order to execute a pathfinder operation, the pathfinder commander follows, to the extent possible, the following troop leading procedures:

*a.* Make tentative plan of operation.

- (1) Study map.
- (2) Make a quick estimate of the situation.
- (3) Begin planning.

*b.* Arrange for—

- (1) Movement of unit (informs second in command).
- (2) Reconnaissance (decide on route, method, schedule, and with whom).
- (3) Issuance of order (select time and place, notify subordinate leaders).
- (4) Coordinate (ground and aviation units).
  - (a) The tactical plan.
  - (b) Air movement plan.
  - (c) Assembly plan and techniques.
  - (d) Determine as much detail as possible.
    1. Loading plan of ground unit.
    2. Landing plan of ground unit.
    3. Study objective area, time and date of landing, and weather to determine—
      - (a) Visibility conditions.
      - (b) Suitability of terrain.
      - (c) Parking, unloading, and departing procedure.
    - (e) Study unit's *SOI*.

(e) From the above, prepare tentative operational plan for the pathfinder detachment.

(f) Make estimate of—

1. Necessity for additional personnel.
2. Necessity for additional equipment or material.
3. Communications plan.

(g) Issue detachment warning order.

1. A brief statement of the enemy and friendly situation.
2. Mission of the detachment.
3. Individual uniform, equipment, identification, and camouflage measures for each member.
4. Work priority for preparation of detachment equipment.
5. Instructions for obtaining necessary rations, water, ammunition, and special items of equipment.
6. Set time and place for the detachment to receive the operations order.

*c.* Make reconnaissance (continue estimate, receive recommendations).

*d.* Complete plan (work out details, formulate orders).

- (1) Present tentative plan to ground unit commander or his staff.
- (2) Prepare final plan based on desires of ground unit commander and his final order.

*e.* Issue detachment order (app. IV).

*f.* Join ground unit.

*g.* Rehearse (if time and terrain permit).

## APPENDIX IV

### PATHFINDER OPERATION ORDER

---

#### 1. General

The operation order is usually issued orally; however, the sample operation order below is included as a guide for pathfinder detachment commanders. It does not include all the details which might be given under different situations. The order is prepared for a reinforced pathfinder detachment supporting an airmobile operation. This type operation is used since it

will be the most common operation of pathfinders in support of assault troop movements. In issuing the order, all available aids should be used. Pathfinders must be aware of which units are to be landed at each side in order to prevent confusion. Units should be made aware of the location and of their alternate landing site if it becomes necessary to close a site because of enemy actions.

#### 2. Sample Order

\_\_\_\_\_  
(Classification)

Copy No. 1  
Pfdr Det 504  
Lawson (901817)  
Jan 63

OPORD I

REFERENCE:

MAPS: Georgia 1:50,000 Seale, Columbus, Lumpkin sheets.

ORGANIZATION: (Annex A)

TIME ZONE: Romeo

##### 1. SITUATION

###### a. Enemy forces.

(1) Units in zone estimated 75 percent strength. Reconnaissance platoon has been reported in objective area near Landing Site Green.

(2) Enemy capable of employing nuclear weapons.

(3) Indications are the enemy will defend.

###### b. Friendly forces.

(1) 1/87 conducts air mobile assault beginning 081345R Jan 63.

(2) 2/7, 2/15, 2/10 Inf on line will attack at H +10 minutes.

(3) 2/27 remains in reserve prepared to exploit a breakthrough on the line of contact or reinforce the airhead.

(4) 1st HOW BN, 5th ARTY in DIRECT SUPPORT.

(5) 6th HOW BN, 43 ARTY in GENERAL SUPPORT.

(6) 1st ROCKET HOW BN, 82d ARTY GENERAL SUPPORT with priority of fires to 1/87 Inf.

\_\_\_\_\_  
(Classification)

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(Classification)

(7) 9th TAF supports atk; priority to 10th INF DIV.

(8) 31st TAC TRANS AVN GP will support w/aircraft.

c. Attachments and detachments.

(1) Liaison officer and radio operator.

(2) Ten-man security detachment A 1/87 Inf.

2. MISSION

Pathfinder Detachment 504 lands in sector by helicopter at H-10 minutes and establishes helicopter landing zone for airmobile assault by 1/87 Inf.

3. EXECUTION

a. Concept of Operation. Pathfinder Detachment 504 lands on assigned operational areas; establishes, and operates landing zone Ajax with four landing sites, release point, and control center at 081325R January 63.

b. Control Center.

(1) Land at coordinate 059857.

(2) Establish ground-air, long-range, and internal communications after navigational aids are emplaced.

(3) Control and operate LZ from H-hour until relieved.

c. Release point.

(1) Land at coordinate 046821.

(2) Establish visual and electronic navigation aids on suitable terrain in the immediate vicinity.

(3) Establish communication with the control center.

(4) Display smoke only on order from the control center.

(5) Be prepared to assume the duties of the control center on order.

d. Landing Site Parties.

(1) Land at the following coordinates as applicable:

(a) GREEN—071843

(b) WHITE—059857

(c) YELLOW—045865

(d) BLUE—059835

(2) Conduct reconnaissance, select, and mark landing sites for three CH-37 helicopters.

(3) Establish communications with control center and give survey results and land azimuth.

(4) Mark troop assembly points as directed.

(5) Mark obstacles as necessary.

---

(Classification)

(Classification)

e. Coordinating Instructions.

- (1) H-hour 081345R Jan 63.
- (2) Tail numbers of CH-37's: 256 and 273.
- (3) Senior pathfinder in each aircraft prepare strip map of flight route.
- (4) Air-movement plan.
  - (a) Control Center: Acft number 256.
  - (b) Release point: Acft number 273.
  - (c) Helicopter site Green: Acft number 256.
  - (d) Helicopter site White: Acft number 256.
  - (e) Helicopter site Blue: Acft number 273.
  - (f) Helicopter site Yellow: Acft number 273.
  - (g) Trail information: 25 to 100 ft, speed 75 knots.
  - (h) Order of landing:
    1. Acft number 256—CC, Helicopter Site Green and Helicopter Site White.
    2. Acft number 273—RP, Helicopter Site Blue and Helicopter Site Yellow.
  - (i) Station time, 1245; Takeoff, 1255; LAND, 1325.
- (5) LZ operational NLT 1335.
- (6) Loading area: 891817.
- (7) Aircraft ready for loading: 1200.
- (8) Troop serials will land echelon left.
- (9) Landing requirements for aircraft: 50-meter circle.
- (10) Two serials of four flights each, with two CH-37's per flight and a time interval of one minute between flights and two minutes between the serials, will land:

Serial number 7—HAWK ONE—Helicopter Site Yellow  
HAWK TWO—Helicopter Site White  
HAWK THREE—Helicopter Site Green  
HAWK FOUR—Helicopter Site Blue

Serial number 2—CONDOR ONE—Helicopter Site Yellow  
CONDOR TWO—Helicopter Site White  
CONDOR THREE—Helicopter Site Green  
CONDOR FOUR—Helicopter Site Blue
- (11) All flights released by pathfinder site commander through CC.
- (12) Alternate landing sites.
  - (a) Blue to White, White to Blue.
  - (b) Green to Yellow, Yellow to Green.

(Classification)

(Classification)

#### 4. ADMINISTRATION AND LOGISTICS

a. The following equipment will be carried by each party in addition to individual equipment and weapons:

(1) CC: Four AN/PRC-10 radios, antenna equipment RC 292, anemometer, necessary batteries, three green and two red smoke grenades, and five VS-17's.

(2) RP: Four green and two red smoke grenades, five VS-17 panels, one homing beacon, and two AN/PRC-10 radios w/batteries.

(3) Helicopter Site: (Each) six VS-17 panels, one AN/PRC-10 radio w/batteries, four smoke grenades (color code of site), and two red smoke grenades.

(4) One assault ration per man.

(5) Ammunition.

(a) M14—six magazines per weapon.

(b) M79— $\frac{1}{2}$  basic load.

(c) .45 cal. pistol—three magazines per.

(d) Frag grenades—two per man (pers w/pistol four).

(6) On-call equipment will be loaded on  $\frac{3}{4}$ -ton prepared for delivery by CH-37. Following equipment prepared for on-call delivery to helicopter landing zone: two AN/CVX-1 beacons, 16 baton flashlights, six each blue, green, yellow, and white lanterns (MX 290's), eight red lanterns, five white lanterns (RP), one RC 292, and extra batteries. One  $\frac{1}{4}$ -ton truck w/radio AN/VRQ-3, one  $\frac{1}{4}$ -ton trailer w/660 rounds M14 rifle ammunition, remainder M79 basic load, four each blue, yellow, and white smoke grenades, 11 green smoke grenades, and 12 red smoke grenades. Individual equipment not carried will be loaded in  $\frac{3}{4}$ -ton trailer with three cases and one box of C-rations (two meals per man).

(7) Wounded will be evacuated on aircraft returning to base when available. In all other cases, request for medical evacuation will go through CC. Wounded will be evacuated prior to PW's. The supported unit will provide guards for all PW's being evacuated to base.

#### 5. COMMAND AND SIGNAL

a. Signal.

(1) Annex H to 10th Inf Div SOI in effect.

(2) Radio listening silence in objective areas until H-3 minutes on all except internal net. Serial leaders will initiate communication with control center.

(3) Code letter "A" displayed at RP.

(4) Yellow smoke at RP for each serial.

(5) Helicopter sites display smoke on-call only.

(6) SOP emergency visual signals in effect.

(Classification)

(Classification)

(7) Call signs.

(a) Control center: AJAX.

(b) Aircraft: HAWK—serial one, CONDOR—serial two.

(c) Abn relay: HANGMAN.

(d) RP and helicopter sites use call signs corresponding to assigned colors and duty.

(8) Frequencies.

(a) Ground-to-air.

1. Primary: 42.3 mc.

2. Alternate: 44.5 mc.

(b) Pathfinder control net.

1. Primary: 39.0 mc.

2. Alternate: 39.5 mc.

(c) Long-range and/or abn relay.

1. Primary: 41.2 mc.

2. Alternate: 45.1 mc.

(9) Two orange VS-17 panels vertically displayed on door side mark assembly points.

(10) Mark obstacles with red VS-17 panels.

(11) Pathfinder radio net for operation of landing zone has priority over tactical use of net.

b. Command.

(1) Senior pathfinder in each party will remain in command until we reorganize on my order.

(2) Co A's initial CP will be at coordinate 077846.

(3) Co B's initial CP will be at coordinate 055863.

SMITH

Capt

Commanding

Annex A—Operation planning form.

(Classification)



## GLOSSARY

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**AIRCRAFT GUIDANCE**—Electronic, mechanical, visual or other assistance given an aviator to help him arrive at, land on, operate within or over, and depart from an air-landing or air-delivery facility.

**AIRMOBILE OPERATION** — Operation in which combat forces and their equipment move about the battlefield in aerial vehicles under the control of a ground force commander to engage in ground combat.

**COMMUNICATION CHECKPOINT**—A pre-designation point on the flight route from which the aviation element initiates communication with the pathfinder detachment in the landing/drop zone.

**CROSS LOADING**—

a. A system of loading one or more units in a single aircraft so they may be disembarked or dropped at a position on one or more landing or drop zones corresponding to their relative assembly areas or areas of operations.

b. A system of loading a unit in two or more aircraft so key personnel, communications equipment, and weapons are split up so the loss of one aircraft will not prevent the completion of the mission.

**HOMING BEACON**—An electronic device used to assist in the guidance of aircraft. It may be a transmitter controlled by an operator on the ground or a transceiver which can be activated electronically by the aviator.

**HOT SPOT**—A point on the taxiway clear of the active runway at which the parking party halts the aircraft before relinquishing control for takeoff; the aviator completes his instrument check for takeoff; and calls the control

center which issues takeoff instructions and final clearance.

**LANDING POINT**—A designated touchdown point on the ground for landing aircraft.

**LANDING SITE**—An area containing one or more landing points.

**LANDING ZONE**—A general area or region encompassing one or more landing sites and necessary control installations.

**PATHFINDER LIGHT BEACON**—A light-transmitting device (incandescent or infrared) used to assist in the guidance of aircraft, assembly of ground units, or both.

**PATHFINDER CONTROL CENTER (CC)**—The communication and operation center from which pathfinders provide navigational assistance for aircraft en route to a drop or landing zone and maintain control of all aircraft within the zone.

**PATHFINDER DETACHMENT**—Army TOE pathfinder organization.

**PATHFINDER GUIDANCE**—Aircraft guidance provided by pathfinders.

**PATHFINDERS**—Individuals who precede or accompany the assault echelon of an Army unit engaged in an air-landed or air-delivered operation to establish and operate navigational aids in the objective area for the transporting aircraft.

**RELEASE POINT**—A manned traffic control point and final navigational checkpoint at which pathfinders employ visual and electronic aids to assist aircraft approaching the objective area.

By Order of the Secretary of the Army:

EARLE G. WHEELER,  
*General, United States Army,  
Chief of Staff.*

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USAQMS (5)

USATSCH (5)

USASCS (5)

USACMLCSCH (5)

USASESCS (5)

USACHS (1)

Units org under fol TOE:

17-22 (5)

NG: State AG (3).

USAR: Same as active Army, except allowance is one copy to each unit.

For explanation of abbreviations used, see AR 320-50.

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FM 57-38      PATHFINDER OPERATIONS—1963